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Energy Generation in the Packing Industry

REFRIGERATING EQUIPMENT AND UNIQUE SYSTEM OF BOILER CONTROL DISTINGUISHING FEATURES IN NEW POWER PLANT OF SIEGEL-HECHINGER CO., CHICAGO

BEFORE THE ESTABLISHMENT of the town and our present order of social and industrial organization, man depended entirely upon his own efforts to supply the needs of himself and his family, and as a result was forced to till the land, weave his own cloth and hunt and fish for his supply of meat. With the coming of the settlement, and after that the town, the activities of the individual became more specialized, and instead of performing all of his former duties incidental to the upbuilding and maintenance of his home, the head of the family was found following some particular vocation in the role of either employer or employe. Further community growth with greater demand for personal and household necessities called for increased supply with the consequence that the various industries were represented by numerous manufacturers instead of but a single one, as in the beginning. At first these industries were, as even now in small towns, scattered about, but as the community grew, the manufacturers appreciating the advantages to be gained thereby in the way of better transportation facilities, bringing them closer to the source of the raw material and to the market of the finished product, to a more abundant labor supply and, in many cases, to a cheaper power supply, began to group them-

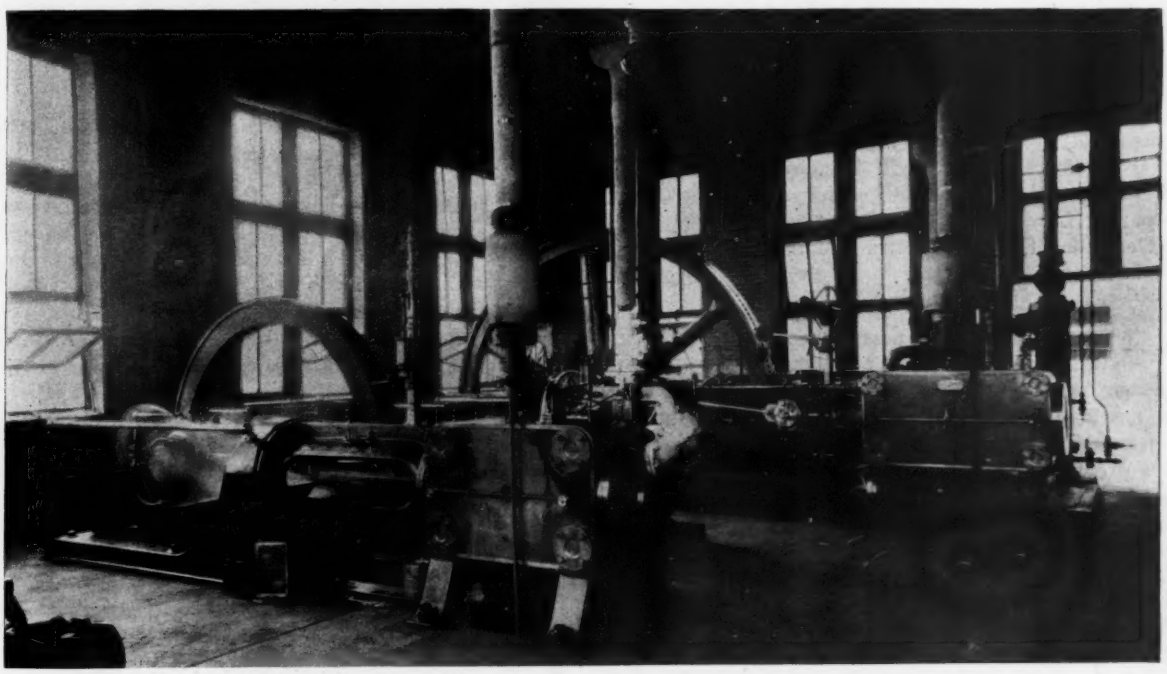


FIG. 1. AMMONIA COMPRESSOR EQUIPMENT CONSISTS OF ONE 30-TON UNIT AND ONE 100-TON UNIT

selves in various districts. An example of this may be found in Chicago, where the many packing houses are grouped in the southwestern part of the city, and where are found not only the large packers such as the Armours and the Swifts, but many of the independent and smaller ones. Placing themselves in such close proximity one to another, each is able to take advantage of the railroad facilities bringing them into closer contact with the live stock merchants, the buyers, and the skilled and unskilled labor, which may be found in that district.

Among the independent Chicago packing companies is the Siegel-Hechinger Co., beef and veal packers, located at 936 W. 38th Place. This plant, established about 9 yr. ago, due to a continued and substantial growth, has been increased in size from year to year until today, when it has an average weekly killing capacity of 1000 head of cattle and 400 to 600 calves. During the last change made in the physical properties, the farsighted-

FIG. 2. ELECTRIC GENERATING UNITS

ness of the management caused to be erected a modern isolated power plant for its supply of electric current for motive power and lighting of the buildings, refrigeration for the chill rooms and hot water and steam for the manufacturing process.

The building housing this plant is a single story and basement, steel, concrete and brick structure, having over-all dimensions of 93 ft. 4 in. by 53 ft. 10 in. and a height of 34 ft. above the ground level. It is entirely separate from the main building and consists of the boiler room, the engine room and the basements below each.

In the Boiler Room

While space has been provided for the future installation of 2 additional units of like size and capacity, the present steam-generating equipment consists of 2 Geary water-tube boilers rated at 210 hp. each and normally operated under a pressure of 140 lb. gage. These boilers are provided with Illinois chain-grate stokers having 45 sq. ft. of grate surface each and are driven by a 4 by 6-in. vertical slide-valve steam engine; a Backlund Regulator controls the stoker speed and damper opening. The setting is of the dutch oven type with inclined ignition arch, while the vertical baffling employed, provides 3 passages for the travel of the flue gases across the tubes.

Boiler makeup water is taken from the city water mains and delivered to the boilers by either one of 2 feed pumps, one of which is a 6 by 4 by 6-in. Platt duplex, while the other is a 7 by 5 by 8-in. Canton-Hughes of the same type. The balance of the boiler water supply is made up of the condensed exhaust steam and that taken from the drips, all of which is delivered to a receiving tank also in the boiler room.

Illinois screenings is the fuel used. This is brought to the plant in carload lots on a spur track running parallel to the north boiler room wall, and is transferred to a bin placed in front of the boilers and having a capacity of approximately 200 tons by means of a conveyor. This conveyor, which was built by the W. A. Jones Foundry and Machine Co. of Chicago, is operated by a 5-hp. direct-current motor and is capable of delivering 15 tons of coal per hour. From the bins the coal is shoveled into the stoker hoppers.

The waste furnace gases of the 2 boilers are cared for by a 150-ft. self-supporting steel stack made up of ¼-in. plates and having an internal diameter of 5 ft.

Due to the power house being provided with a basement, where are the toilet rooms and supply and repair-part storage rooms, it was necessary to mount the boilers on 2 brick piers having a height of 8 ft. 9 in., as shown in the plan and elevation, Fig. 3. While the rear pier is built solid, the front pier is made hollow with a partial concrete fill forming a receiving pocket for ashes and cinders falling from the grate above. Cast-iron doors in the front of the piers provide a ready means for the removal of these ashes into wheelbarrows. Cinders collecting in the combustion chamber between the bridge wall and the rear wall of the setting are removed through an opening fitted with an iron door in the ceiling of the boiler room basement between the 2 piers.

The remaining boiler room equipment consists of one 6 by 4 by 6-in. Platt duplex pump for general pumping purposes, one 8 by 6 by 10-in. Canton-Hughes duplex pump for house service and the supply of water on the killing floor, a Colles feed water heater and a receiving tank or warm well.

Stoker and Damper Control

By means of the Backlund Regulator mentioned above, which controls both the rate of travel of the stoker grate and the degree of damper opening, not only is a practically constant steam pressure maintained but a minimum consumption of fuel realized, it having been stated by the engineer in charge that since the introduction of this regulator the coal used has been reduced nearly 10 per cent.

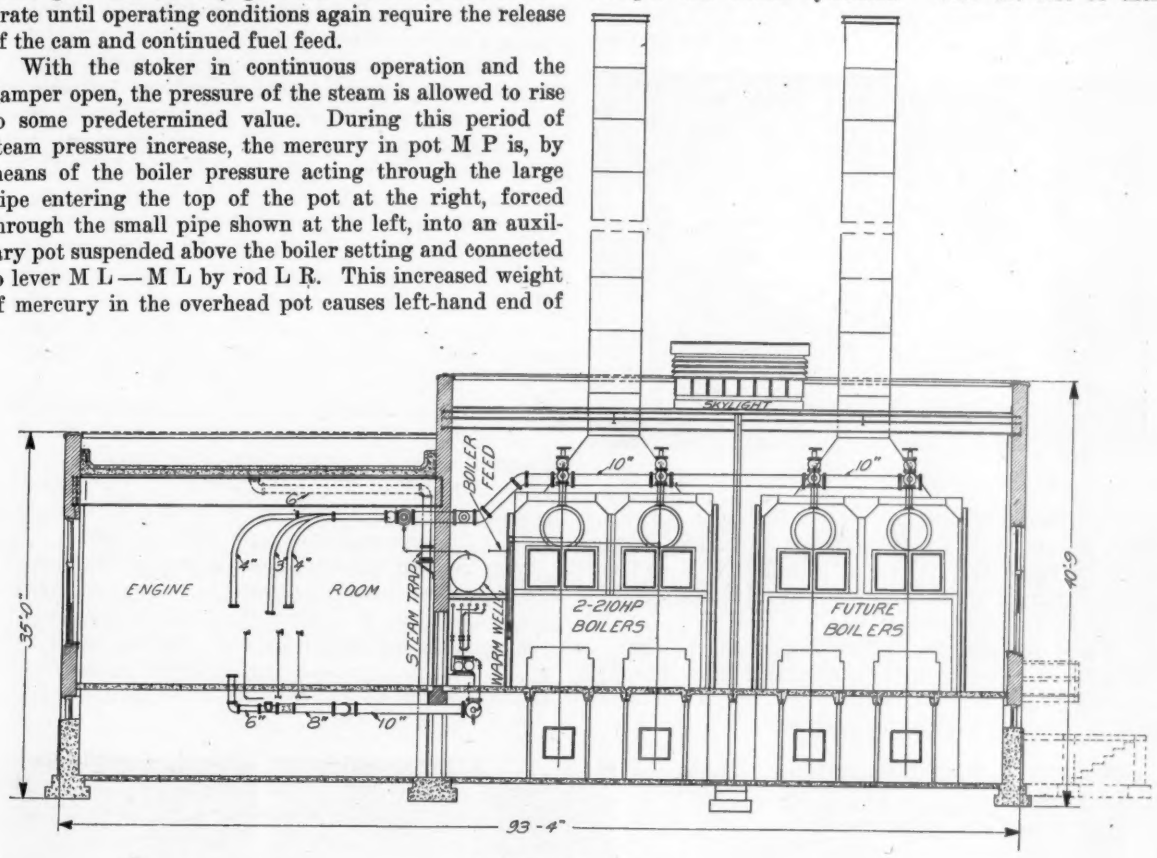
While the exact location of the Backlund Regulator along the side of the boiler setting may be noted in Fig. 4, details of the mechanism are shown in Fig. 5. Essentially this regulator consists of 3 component parts, a master control mechanism and 2 auxiliary controls, one for the stoker grates and the other for the damper.

The master control mechanism as shown in the center of Fig. 5 consists of a mercury pot, M P, placed on the boiler room floor, a smaller and movable auxiliary mercury pot (not shown) suspended above the boiler setting and connected to lever M L — M L through the medium of lever rod L R, a frictionless 3-way valve, V, valve operating arms A A, and main hydraulic cylinder M C.

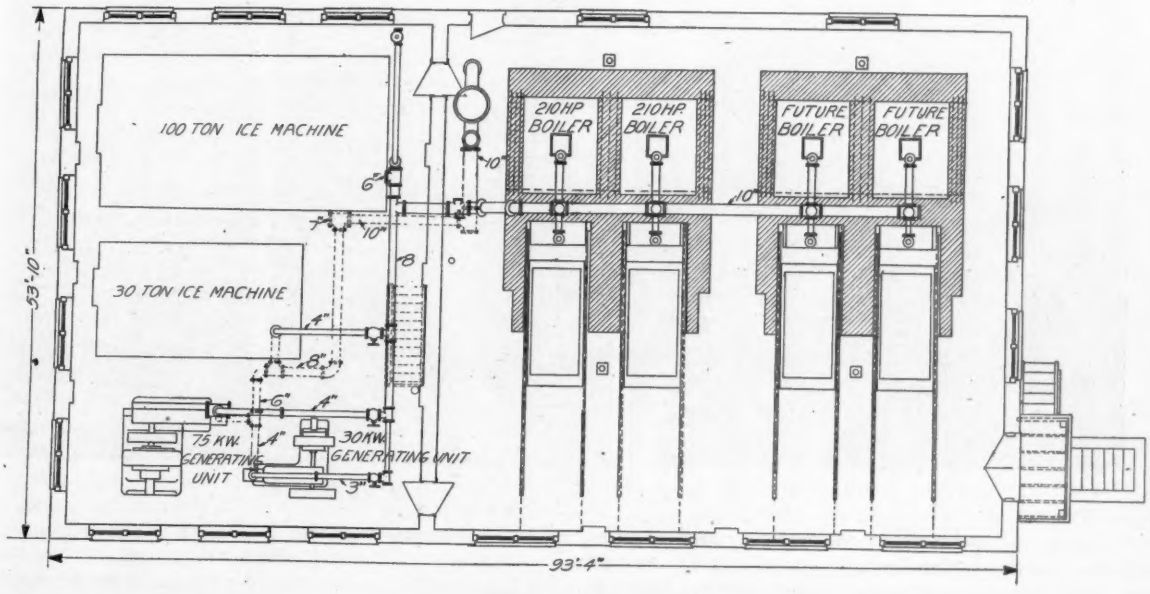
The auxiliary damper control mechanism shown at the right of Fig. 5 consists of hydraulic damper cylinder C D provided with a leather cup, or plunger, connected by means of a rod and chain to the damper. A similar

hydraulic cylinder shown at the left of Fig. 5 and marked C G controls cam D B, which under the proper conditions raises the dog operating the stoker worm and grate gear and thereby prevents further travel of the grate until operating conditions again require the release of the cam and continued fuel feed.

With the stoker in continuous operation and the damper open, the pressure of the steam is allowed to rise to some predetermined value. During this period of steam pressure increase, the mercury in pot M P is, by means of the boiler pressure acting through the large pipe entering the top of the pot at the right, forced through the small pipe shown at the left, into an auxiliary pot suspended above the boiler setting and connected to lever M L — M L by rod L R. This increased weight of mercury in the overhead pot causes left-hand end of lever M L — M L to drop, with the result that upper arm A A opens 3-way valve V and allows water taken from the city water mains to act upon the plungers in the damper and stoker cylinders. With the rise of these



LONGITUDINAL SECTION



FIRST FLOOR PLAN

FIG. 3. PLAN AND ELEVATION OF SIEGEL-HECHINGER CO.'S POWER PLANT

plungers, the damper is gradually closed and cam D B caused to raise the stoker operating dog and thereby prevent further grate travel.

With a lowering of the steam pressure this procedure is, however, reversed. The mercury now flows from the auxiliary pot to main pot M P and, due to the decrease

FIG. 4. GENERAL VIEW OF BOILER ROOM

of the overhead weight, left-hand end of lever M L—M L rises, 3-way valve V is closed, the hydraulic pressure removed from the plungers in cylinders C D and C G and the damper opened and the stoker dog again allowed to engage with its sprocket wheel.

Water pressure for the raising of the plungers in cylinders C G and C D is transmitted through supply lines W G and D C L respectively; lines D G and D D conduct the discharge to the sewers.

Main Piping System

Four and one-half inch Ashton pop safety valves and 6-in. Foster stop valves are used on boilers; the 2½ in. blowoff valves of which there are 2 for each unit connected in series, are of the Everlasting and Crane makes, the latter being next to the shell.

Steam is delivered to the engines through a main header running parallel and adjacent to the west wall of the engine room and made up of 8, 6 and 3-in. sections and long-turn bends fitted with stop valves where joined to the header.

Lines carrying exhaust steam from the engines are suspended from the ceiling of the engine-room basement and are connected to a 12-in. header carried adjacent and parallel to the east wall of the boiler room basement. This header then rises and connects to the feed-water heater in the boiler room above, provision, however, being made by means of a system of by-pass piping and a 10-in. Foster back-pressure valve to allow the escape of the exhaust steam to the atmosphere when desired or required. Ordinarily, however, after leaving the heater the steam is further employed to heat the water used on the killing floor and for cleaning purposes. This is accomplished by the use of 2 5000-gal. tanks each provided with coils made up of approximately 100 ft. of 4-in. piping through which the steam passes and in which it is condensed ready to be returned to the receiving tank in the boiler room and from there to the boilers. This arrangement not only allows the abstraction of almost all of the available heat in the exhaust steam, but, due to the condensation thereof, creates a partial vacuum in the exhaust header and branches.

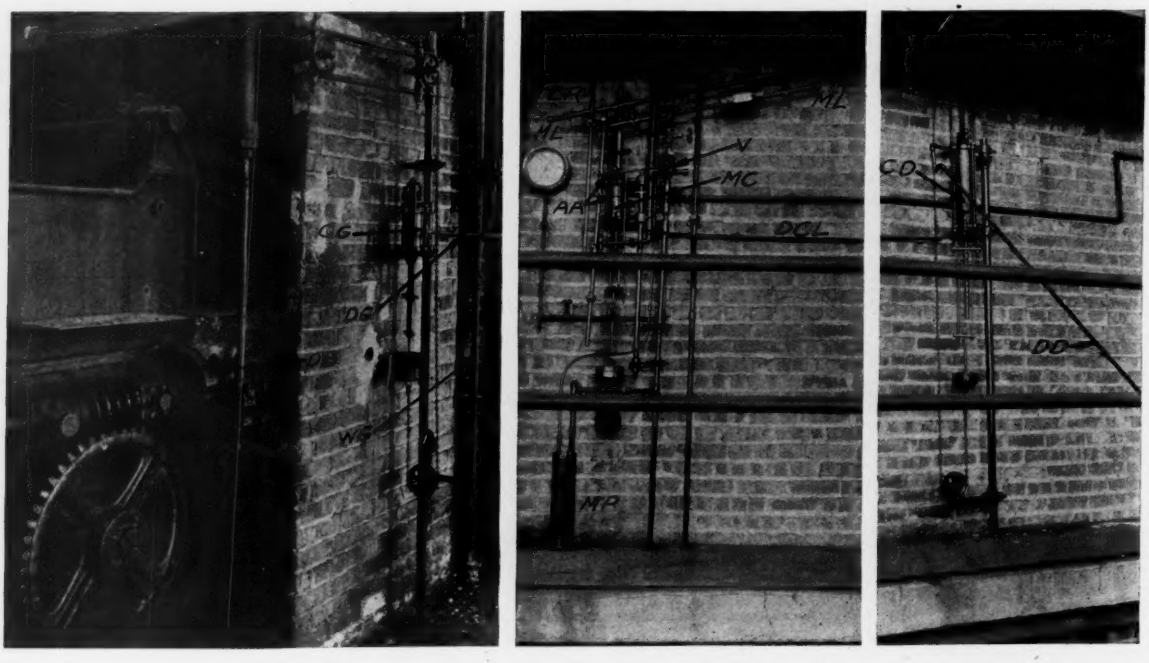


FIG. 5. THE BACKLUND DAMPER AND STOKER REGULATOR

Proper adjustments of the various counter-weights attached to the hydraulic cylinders and balancers on the lever M L — M L allow a damper setting and stoker feed such as to maintain a variation of steam pressure of no more than 2 to 3 lb. under a wide range of load.

In the manufacturing process, live steam is employed exclusively. This is delivered to the packing house by 2 2-in. and 1 3-in. lines and by means of Foster reducing valves placed on each of these lines is reduced in pressure from 140 to 40 lb.

All high-pressure and exhaust steam lines are well insulated with sectional magnesia covering.

Engine Room Equipment

The entire connected electrical load is made up of 45 hp. in motors and 23 kw. in lighting units, making a total of approximately 58 kw. To supply the current for this, 2 generating sets, one a 30-kw., 115-v. Jenney direct-current generator direct connected to a 10 by 11-in. Chuse steam engine operating at a speed of 310 r.p.m. and one 75-kw., 115-v. direct-current Crocker-Wheeler generator, direct connected to a 13 by 12-in. Skinner steam engine operating at 275 r.p.m. have been installed.

In addition to the electrical generating units, the engine room also houses 2 ammonia compressors in conjunction with the refrigeration system which is of the direct expansion type. This equipment, which occupies the south end of the engine room, consists of one 30-ton Rebsamen and Almeroth compressor direct connected to a 14 by 30-in. Vilter Corliss engine having an average speed of 80 r.p.m. and one 100-ton Wolf compressor driven by an 18 by 42-in. Filer and Stowell Corliss engine, the average speed of which is 60 r.p.m.

The ammonia condensing equipment located on the roof of the engine room directly above the compressors is built up of 4 sections each carrying 24 25-ft. lengths of 2-in. pipe and has a condensing capacity capable of caring for 50 tons of refrigeration. To meet a probable future growth of the business and consequent growth of plant provisions have, however, been made to accommodate a 250-ton condenser.

Proper preservation of the beef and veal requires it to be maintained at a low temperature and for this purpose 2 chill rooms placed end to end and having a combined length of 125 ft., a width of 40 ft. and a height of 28 ft., and capable of holding 400 beeves each, are provided. After the beef has received its final dressing, but while still warm, it is brought into the first chill room and kept at a temperature of 38 deg. F. for a period of 12 hr. to 6 days, depending upon the movement of the market. It is then passed to the second chill room, the temperature of which is maintained at 34 deg. F. and held there for a similar period.

The insulation employed in the construction of these chill rooms consists of a double layer of 2-in. cork separated by ⅝ in. of cement plaster.

Newer Types of Steam Engines*

CERTAIN types of steam engines which are comparatively new in this country have shown steam economies in tests much superior to any recorded by the types of steam engines usually found in isolated plants. Such types of engines are the uniflow and the poppet valve.

Uniflow engines are now manufactured in this country by the Ames Iron Works, The Skinner Engine Co., the Mesta Machine Co., the Erie City Iron Works, the Nordberg Manufacturing Co., and the Harrisburg Foundry and Machine Works. These engines secure improved economy by reducing the initial condensation of steam, and tests have shown some very low steam consumptions.

*From a report read before the N. E. L. A.

The poppet valve is employed primarily to allow the use of superheated steam at high pressures, a combination which cannot be employed satisfactorily with the ordinary slide, piston and Corliss valves. This type of engine is very popular in European practice, especially in large plants, and low steam economies have been shown. The poppet-valve engine is made in the United States by the Erie City Iron Works, the Nordberg Manufacturing Co., and the Skinner Engine Co.

Both the poppet valve and the uniflow engines operate most economically at steam pressures higher than those usually found in isolated plants. The cost of the poppet-valve engine is about the same as that of a high-grade Corliss engine. A recent installation of these engines, consisting of 3 units aggregating about 800 kw., cost, for the engines alone, approximately $18 per kw. It is reported that their operation has been far from satisfactory. While the guaranteed steam consumption of this type of engine is somewhat lower than the Corliss, the actual economy is probably little if any better than that shown by a high-grade engine of the Corliss type.

The uniflow type of engine costs considerably more than engines of the Corliss type. A 140-kw. unit, recently installed in a plant near New York City, cost $5000 for the engine alone, or $36 per kw. This is about 30 per cent more than a Corliss or 4-valve engine of this size would have cost.

The advisability of investing additional money in an engine of superior steam economy, hinges entirely upon the amount of exhaust steam which can be utilized. Where any considerable amount of the exhaust is used, the amount of steam chargeable to the generation of electrical energy is little less with a uniflow or poppet-valve engine than with a high-speed slide valve engine. As this condition is usually found in isolated plants—their existence depending upon it to a great extent—the importance of these types of engines as competitive power sources is not so great as their superior steam economy would lead one to expect.

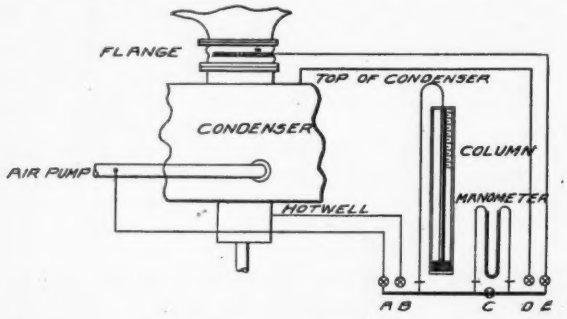
An effort was made to secure steam economy guarantees and installation costs from various builders of these engines, but for certain reasons the manufacturers were unwilling to furnish such figures. Their catalogs give the results of tests, but it was impossible to check these with operating figures from any plants which are using engines of either of these two types. One plant owner who is now operating 3 uniflow engines with a combined rating of 275 kw., is at present negotiating for an auxiliary connection with the central station to carry the load in a new adjoining building, rather than install another unit, which may or may not be indicative of his opinion of engines of the uniflow type.

A general impression has existed that there was prospect of a serious scarcity of coal in Uruguay, chiefly because it is being sold at retail for $28.96 per ton. An investigation shows that while a scarcity is not immediately to be expected, as there are about 60,000 tons of coal either there or on the way, dealers attribute the high price to the extraordinary rise in freights in the last few months. It is believed that there is an early prospect of a return to a more reasonable price.—Commerce Reports.

Vacuum Observations on Turbines and Condensers

By H. A. Cozzens, Jr.

In the majority of central stations, a close watch is maintained on the performance of surface condensers so as to attain the highest operating efficiency. The observation which demands the most attention is the vacuum produced by the condenser. The usual practice is to obtain the vacuum reading at the top of the condenser and to base the performance on this reading. Very interesting data may be obtained if the vacuum reading is taken at various points in the condensing equipment. The advantages of such a procedure are, first: the performances of different parts of the condenser can be gauged by the different readings obtained. A series of these readings will show the drop through the condenser from the top to the hotwell giving data on the friction and other losses. Furthermore, if the vacuum reading be taken in but one place it might be influenced by pockets and an erroneous reading would



CONNECTIONS FOR TAKING VACUUM READINGS AT VARIOUS POINTS OF THE CONDENSER

result. When testing turbines and condensers, it is advisable to set up a series of mercury columns and observe the vacuum at different points.

In the illustration, a scheme for taking various vacuum observations using but one mercury column located in a central position is shown. Pipe lines leading from points at the top of the condenser and also from the hotwell are led to header in the center of which the mercury column is attached. By opening one valve at a time readings may be taken at the various points.

In the header provision is also made for a manometer filled with water and by use of which the drop between the upper and lower points may be obtained. The valve at C is closed, dividing the header into 2 parts. When not in use valve C may be opened and the pet cocks on the manometer closed. In using such an arrangement care should be taken to make all joints in the piping tight, and it is best to paint them so as to be free from leaks.

When the condenser and turbine are supplied by different builders, each will want the vacuum observation made in his particular part of the equipment. There may be a loss in the expansion joint and the turbine builder will not want to base the turbine performance on a vacuum reading made at the top of the condenser. The logical place to take the vacuum reading is in the expansion joint. This may be easily done by inserting a drop leg to which is attached a length of pipe extending across the joint and which has been drilled with small holes following the path of a spiral. The use of this arrangement will result in a reading which is accurate.

The advantages of the scheme shown in the illustration are flexibility and facility in obtaining observations.

A preliminary statement of the general results of the 1914 census of manufactures with respect to the cast-iron pipe industry has been issued by Director Sam. L. Rogers, of the Bureau of the Census, Department of Commerce. It consists of a statement of the quantities and values of the various classes of cast-iron pipe and fittings manufactured, prepared under the direction of William M. Steuart, chief statistician for manufactures. The figures are preliminary and are subject to such change and correction as may become necessary upon further examination of the original returns.

Manufacture of Cast-Iron Pipe—Comparative Statistics: 1914 and 1909
(Tons of 2000 lb.)

ESTABLISHMENTS AND VALUE OF PRODUCTS	
Number of establishments:	
1914	[1] 61
1909	52
Per cent of increase	17.3
Total value of products:	
1914	[1] $26,546,090
1909	$29,153,723
Per cent of decrease	9.6
PRODUCTS IN DETAIL, 1914	
Cast-iron pipe and fittings:	
Tons	[1] 1,052,601
Value	[1] $24,363,031
Gas and water pipe—	
Tons	866,936
Value	$18,862,835
Bell and spigot pipe—	
Tons	796,694
Value	$16,063,374
Flanged pipe—	
Tons	19,883
Value	$493,047
Culvert pipe—	
Tons	10,952
Value	$245,452
Fittings—	
Tons	39,407
Value	$2,060,962
Soil and plumbers' pipe and fittings—	
Tons	185,565
Value	$5,500,196
All other castings:	
Tons	26,199
Value	$741,381
All other products, value	$1,441,678

[1] In addition, 8 establishments engaged primarily in the manufacture of products other than cast-iron pipe made 38,707 tons of cast-iron pipe and fittings, valued at $1,028,683.

Oil Fuel--I*

ITS PHYSICAL PROPERTIES; METHOD OF HANDLING; FURNACE DESIGN AND BURNER REQUIREMENTS. BY ERNEST H. PEABODY

CLASSIFICATION of oils according to their density is commonly used to denote other characteristics. Thus, a "heavy" oil is usually expected to be viscous and sluggish with a high percentage of asphalt and comparatively low heat value, while a "light" oil is supposed to be very fluid at ordinary temperatures, volatile and rich in the lighter hydrocarbons and high in heat value. While in general, these characteristics hold true enough to explain the prevalent association of ideas, there are so many exceptions and variations that it is essential to specify clearly the various properties of a particular oil in order to identify it. Density is not a measure of volatility, nor does weight necessarily determine viscosity.

HEAT VALUE

FUEL OIL depends for its heat value almost entirely upon hydrogen and carbon, which although present in the liquid in many different combinations, still do not vary greatly in relative proportions when reduced to ultimate analysis. Thus, the hydrogen content of various crude oils varies usually from about 11 or 12 per cent to about 14 per cent, and the carbon from about 84 to 87 per cent, slight amounts of oxygen, nitrogen and sulphur also being present.

The ultimate analysis may serve for calculating the heat value of a fuel, but the use of the bomb calorimeter of the Mahler type is universally accepted as standard. In this instrument the latent heat of the vapor formed by the combustion of the hydrogen is included in the result—this proportion of the heat value is, however, not available for use in a furnace where the vapor passes away as superheated steam.

The heat value of fuel oil varies between about 16,000 and 20,000 B.t.u. per pound, 18,000 to 19,000 being the common values.

VISCOSITY

WITH the advent of the viscous crude oils of Mexico and the increased use of heavy distillates from other fields, coupled with the wider adoption of the mechanical atomizer, the degree of viscosity of the oil becomes a matter of considerable importance.

Viscosity may be described as the resistance to internal movement, or the internal friction of a liquid. It may be measured in various ways, as, for instance, observation of the ability of the liquid to oppose the movement of a body through it or immersed in it (Doolittle's disc, for example) or more commonly by noting the time required for a definite quantity of the liquid to pass through an orifice or short pipe under known conditions of temperature and head. This latter principle is used in the best known types of viscometers as developed by Saybolt, Redwood and Engler.

In atomizing oil by means of the mechanical atomizer or pressure burner, it is important to know to what degree the viscosity must be reduced and to what temperature the oil must be heated to accomplish this result. Also, the most viscous oils cannot be pumped without heating. The whole problem, therefore, of handling heavy oil—in fact any oil—really hinges on the matter of viscosity.

FLASH POINT

"FLASH-POINT" of oil is the temperature at which inflammable gas or vapor is given off. It is determined simply by heating the oil and as the temperature rises testing it with a spark or flame until the vapor is distilled off and ignites and the "flash" is noticed. The oil must be carefully stirred in order to get a uniform temperature and measure it correctly, and it is obvious that conditions of the test may introduce wide differences in results. Thus, merely by closing in the top of the vessel in which the test is made, the "flash" will be detected sooner and at a lower temperature than if the vessel is entirely open. This explains the use of the "closed-cup" as opposed to the "open-cup" apparatus. The former is the more accurate.

The "burning point" is the temperature at which sufficient vapor is given off to remain ignited, and as a free supply of oxygen is required, this test is made with the open cup.

Certain oils require heating above the flash point—not for any supposed advantage of allowing the oil to flash into gas, but merely for the purpose of reducing the viscosity to a point where the mechanical atomizer will handle the oil successfully. This is undoubtedly a condition which introduces an element of danger in the use of oil on shipboard. Some slight unnoticed leak in the piping system or at a burner may allow gas or vapor to collect in the fireroom, which on being mixed with a certain proportion of air and exposed to a naked light, may produce a more or less disastrous explosion.

This element of possible danger is often set aside as of trifling consequence, or not considered at all, or no leak in the piping having occurred, it is contended that none ever will.

Further, it is claimed by some authorities that the vapor which would be liberated in this way is exceedingly small—not enough in fact to introduce any considerable danger.

It must be understood that only a part of the oil is volatilized when a temperature above the flash point is reached; that is, there is no possibility of the whole body of the oil flashing into vapor, but even if a portion is given off, the amount of this vapor may be constantly added to by new oil approaching the hidden leak.

SPECIFIC GRAVITY

THE BAUME HYDROMETER SCALE for liquids lighter than water has obtained a strong hold in the oil industry, and for light oils this practice is justified by the ease with which the "gravity" may be determined—namely, by the simple reading of the scale on the stem of the

*Taken from a paper presented at the International Engineering Congress, San Francisco, Cal. This abstract will be published in 4 parts.

hydrometer immersed in the liquid. But for heavy viscous oil, the very nature of the oil makes the process a slow one and liable also to considerable error. It is believed by some that for these oils it is much better to determine the weight of a known volume of the oil (as in the specific gravity bottle), and report the density in terms of the density of water at 60 deg. F. (15.55 deg. C.), that is, as specific gravity.

On the other hand, there are advocates of the method of heating the viscous oils sufficiently to make the use of the Baume hydrometer feasible—making the necessary corrections for temperature.

The reluctance to abandon the Baume scale and give the actual specific gravity is due probably to our inherent dislike continually to report results in fractional units; but as the oils in general use become heavier and the hydrometer itself becomes impracticable, it is probable that the Baume scale will be less commonly used. In fact, already oils of 10 deg. Baume (the specific gravity of water) are used as fuel, and should the limit

SPECIFIC GRAVITY AND WEIGHT OF LIQUIDS LIGHTER THAN WATER CORRESPONDING TO VARIOUS BAUME SCALE READINGS

Baume Liquids Lighter Than Water	Specific Gravity 60 deg. F.	Weight in Pounds - 60 deg. F.		
		Per U. S. Gal.	Per Cu. Ft.	Per Barrel 42 Gal.
10	1.000	8.337	62.368	350.2
11	0.993	8.280	61.93	347.7
12	0.986	8.222	61.50	345.3
13	0.980	8.171	61.12	343.2
14	0.973	8.112	60.68	340.7
15	0.966	8.054	60.25	338.3
16	0.959	7.996	59.81	335.8
17	0.952	7.937	59.37	333.4
18	0.946	7.887	59.00	331.3
19	0.940	7.837	58.63	329.2
20	0.933	7.779	58.19	326.7
21	0.927	7.729	57.82	324.6
22	0.921	7.679	57.44	322.5
23	0.915	7.629	57.07	320.4
24	0.909	7.579	56.69	318.3
25	0.903	7.529	56.32	316.2
26	0.897	7.479	55.94	314.1
27	0.892	7.437	55.63	312.4
28	0.886	7.387	55.26	310.3
29	0.881	7.345	54.95	308.5
30	0.875	7.295	54.57	306.4
35	0.848	7.070	52.89	296.9
40	0.823	6.862	51.33	288.2

go a bit further, we should be confronted with the alternative either of reporting the density in terms of specific gravity, or of bringing into use the other Baume scale, for liquids heavier than water—a most undesirable complication.

The United States Bureau of Standards has adopted the following for converting readings on the Baume scale lighter than water, to terms of specific gravity: Divide 140 by the sum of 130 plus the reading of the Baume scale; this at a temperature of 60 deg. F.

Specific Heat of Oil

The specific heat of oil varies with its composition. It will be greater the richer the oil is in hydrogen, and lower in proportion to a greater carbon content.

The following figures are reproduced from Holde's work on Examination of Hydrocarbon Oils:

Crude Oils From—	Sp. Gr.	Sp. Ht.
Japan	0.862	0.453
Pennsylvania	0.810	0.500
Russia	0.908	0.435
California	0.960	0.398
Bustenari	0.842	0.462

Coefficient of Expansion of Oil

It may be considered that at ordinary temperature crude petroleum expands under the influence of heat approximately 0.0005 of its volume for each degree F., or 0.0009 per degree C. This coefficient decreases for the heavier oils, being a function of the specific gravity.

Corrosion Due to Oil

Certain grades of the heavier oils contain considerable sulphur, and the question is frequently asked whether or not the corrosion from this cause may result. At the opening of the Beaumont fields, particularly, there were many, who on general principle, prophesied rapid deterioration of boiler surfaces, without giving due thought to the fact that certain kinds of coal having a larger sulphur content than the oil had for years been used for fuel without serious trouble. Experience has demonstrated that sulphur in oil has no bad effect on boilers, except in cases of neglect, when pitting may occur under certain conditions, the same as with coal.

Corrosion of copper heating coils has, however, been noticed in the presence of sulphur-bearing oils, and for this reason it is the recognized practice to use steel coils. Brass and bronze fittings may be used, however, with safety, both in pumps and on pipe lines, and doubtless brass heater tubes could be employed if desired.

The Bureau of Standards, Department of Commerce, Washington, D. C., has developed a radio-direction finder which is reported simple and practical and at the same time very efficient in operation. It indicates the direction of the source at the same time that the messages are being received, and while it is very sensitive to radiations in a given direction it is less affected by atmospheric disturbances and interfering radiations from other directions than an ordinary receiving apparatus. This apparatus appears to be well adapted to use on merchant and naval ships to obtain the direction from any light houses or light ships that may be equipped with radio fog signaling apparatus; to obtain the direction of one ship from another at sea; to communicate between ships or ship and shore stations irrespective of direction by reducing interference and atmospherics; to use by the War Department in field service, as the receiving apparatus is portable and requires no ground or antenna, and can be carried readily in a light vehicle or even by a single observer; to use by the Coast Guard Service to receive distress signals and locate the direction; for use by the Bureau of Navigation to locate amateur or other stations that are not observing the radio regulations or are otherwise interfering with radio-transmission of the Government or legitimate commercial business.

The Bureau of Standards is prepared to demonstrate the apparatus to representatives of the War and Navy Departments or other interested Departments.

A man in Russia requests an American consular officer to place him in touch with manufacturers of refrigerating machinery, elevators, and technical supplies. The man is also an exporter of raw products, such as skins, furs, etc. Correspondence may be in English. References are given to the U. S. Bureau of Commerce.

Electrical Machinery and Appliances

For Generating, Transmitting and Using Current

Rigid Conduit Wiring Hints--II*

DESCRIPTIONS OF FITTINGS AND METHODS OF GROUNDING. BY TERRELL CROFT

SERVICE connection and main-run conduits may be arranged as suggested in Fig. 8. Each run extends continuously between steel cabinets, which are really outlet boxes of a special type.

A conduit system should always be first installed complete without the conductors, for the reasons given in a preceding paragraph wherein it was noted that if the conductors were placed within the tubes prior to the completion of the building, there is always the possibility that they may be damaged or cannot be withdrawn.

CONDUIT FITTINGS

STEEL OUTLET PLATES and boxes are formed as suggested in Fig. 9. These outlet plates and boxes have 3 distinct functions. The first is to insure the mechanical continuity of the metallic lining of the wire raceways which is provided by the conduit tubes. The second is to provide substantial support for the conduit and fixture ends at outlets. The third is to complete the electrical continuity of the grounded conduit system.

Outlet boxes are preferable to outlet plates because the boxes provide a roomy recess lined with noncombustible material in which taps or splices may be made. Outlet boxes are imperative at switch outlets; but the plates may be used at fixture outlets, provided the fixture has a canopy which forms a chamber. Where a lighting appliance has no canopy, as for instance, a drop cord or rosette, an outlet box with a suitable steel cover should be used.

Approved outlet fittings must be used in open-work conduit installations at the terminations of conduit runs as shown at Fig. 6. Iron bushings were formerly approved for protecting conductors against abrasion at conduit ends in exposed work, but their use is no longer sanctioned. As shown in Fig. 10, the noncombustible bushing (usually of porcelain) on an outlet fitting serves to insulate the conductors emerging from the tube from one another and to maintain a suitable separation between them where the conductors emerge from the protection of the conduit.

An outlet plate should never be used where it is possible to install an outlet box. As is evident from Fig. 9, a box affords better protection for the conductors. A plate does not provide a steel clad chamber, but does, when the conduits enter it and when they are fitted with locknut and bushings, connect the different sections together electrically and it provides substantial support for the conduit ends, thereby retaining them in position.

In setting outlet boxes, plates or cabinets for concealed conduit wiring installations on plastered surfaces, they should always be so arranged that their edges are not more than ¼ in. back of the plastered surfaces and should fit snugly in the hole; otherwise, the wiring recess thus provided will not be completely lined with metal and the ends of the laths or other combustible material that is exposed may be the source of fire risk. Gaps around the edges of an outlet box may allow a draft to promote a fire if one is started within the box and, furthermore, may allow a fixture canopy to sink into the hole and come in contact with the outlet box from which it should in most cases be insulated.

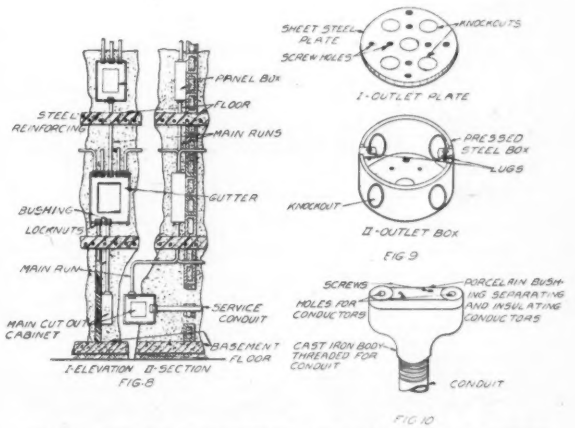


FIG. 8. SERVICE CONNECTION AND MAIN-RUN CONDUITS
FIG. 9. PRESSED STEEL OUTLET BOX AND OUTLET PLATE
FIG. 10. TYPICAL APPROVED OUTLET FITTINGS

Outlet boxes, plates or cabinets mounted on wood surfaces should have their outer edges flush with or projecting beyond the wood, so as to protect it from the possibility of being ignited.

Where outlet boxes or plates are omitted, the conduit ends should be connected (wired) together to insure electrical conductivity of the entire conduit system. They should be retained firmly in position with pipe straps or by other means.

Galvanized or sherardized conduit and fittings are preferable, as a rule, for concealed conduit installations because with them good electrical contact is always pro-

*Continued from page 534, June 15 issue.

vided between the components of the system. Where conduit and fittings are enameled it is always necessary to scrape the enamel, which is a reasonably good insulator, from the outlet boxes and other fittings to insure conductivity. Note that (rule 28f, paragraph 2) gas pipes where they enter outlet boxes must be in good electrical connection therewith.

Conduit bushings are required on the end of every run of conduit terminating in an outlet box unless some other device which accomplishes the same end is provided. The bushings, Figs. 2 and 7, protect the conductors from the sharp edges at the pipe end. These keen edges are formed when the conduit is cut off with a pipe cutter or a hack saw, and although reaming the ends of the tube usually cuts away the sharpest edge, it seldom makes it smooth enough so that conductors can rub on it without injury. The bushing is made with a rounded edge which is not likely to abrade the insulation of the conductor.

Grounding of Systems

Effective grounding of a conduit system is necessary to minimize fire hazard. It is impracticable, if not impossible, to insulate the conduit of a system from ground; hence, the obvious procedure is to ground it permanently and effectively. The reasons for grounding a metallic conduit system are the same ones that dictate the grounding of motor and generator frames.

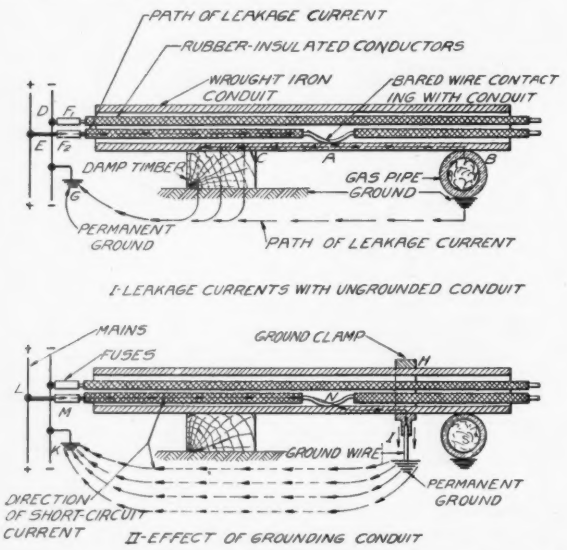


FIG. 11. UNGROUNDED AND GROUNDED CONDUIT SYSTEMS

What might occur in an ungrounded and a grounded conduit system is illustrated in Fig. 11. The tubes and metal parts of the conduit system in their ramifications about a building may come in contact with numerous grounded objects. For example, the tubing might rest on damp wood, as at C in Fig. 11, I, or on a gas pipe as at B. Now, if one of the conductors carried within the system became bared and contacted with the tube as at A, and there happened to be another ground, G, on the other conductor (of opposite polarity) of the system, trouble might occur. Note that the one ground at A on the positive side of the circuit could not of itself make trouble, provided there were no ground at G on the negative side; but in practice, there is liable to be a ground on either side of a system. In fact, alternating-current secondary circuits should always be permanently grounded as specified in rule 15b, and, furthermore, the neutral of a direct-current 3-wire system should be grounded as specified in rule 15a.

Thus, with conditions as above described a current might flow along path E, F_2, A, C, G, that is, a current would flow through the damp timber to ground. The current might be of small intensity because it might be limited by the high resistance of the damp timber, but it could be of sufficient intensity to char the timber and yet not operate cut-out F_2. Ultimately, timber C might be ignited and a fire result.

Furthermore, current might flow along path E, F_2, A, B, G, through point B, where the conduit contacts with the gas pipe. The contact might be of such high resistance that the current flowing would not be great enough to operate F_2, but this current might at the same time be such that the arc produced by it at point of contact B would burn a hole in the pipe and possibly ignite the gas.

Now, if the conduit system is permanently and effectively grounded as at HI (Fig. 11, II), and one of the wires of the system accidentally contacts with the conduit as at N, then a large current would flow along path LMNIK because the resistance of the permanent ground would be very low. This heavy current would almost instantly operate cut-out M, disconnecting the location of the trouble from the source of electromotive force. Furthermore, a fuse would not hold at M until the trouble was corrected.

Not alone does permanently grounding the conduit insure against fire hazard, but it also may insure against life hazard for the same reasons that grounding a generator or motor frame or the secondary of a distributing system gives this insurance. It is obvious, then, that the ground on a conduit system must be a thorough one.

Electrical continuity of the conduit system is essential. It is evident that all parts, tubing, outlet boxes, outlet plates, junction boxes and metal cabinets must be electrically connected so that a ground on the system will afford protection to all parts of it. It is apparent, too, that the joints or points of contact between the different components of the conduit system should be of low resistance, otherwise grounding will not afford the protection expected of it.

The methods of connecting ground wires to conduits and to ground pipes may be divided into 2 general classes: (1) Connections with approved ground clamps as shown in Fig. 12, and (2) Special methods which do not involve the use of ground clamps.

Although approved ground clamps of one type or another are ordinarily employed, inspectors will frequently approve ground connections effected with other "home-made" appliances, provided the appliance affords a substantial and reliable attachment between the conduit system and the ground pipe. Some of the methods used in grounding motor and generator frames, 3-wire system neutrals and alternating-current transformer secondaries may often be used to advantage in grounding conduit.

Ground clamps provide a means of effecting a good electrical and mechanical attachment of the ground wire

to the conduit and to the pipe to which the system is grounded. At least one clamp is used on the conduit and one on the pipe affording the ground. A ground wire is arranged between the 2 and soldered in the lug of each. The ground clamps should be accessible for inspection so that one may assure himself of their integrity. The method of making up the ground clamp illustrated in Fig. 12 around a pipe or conduit is shown in Fig. 13, which is self-explanatory.

Conduit should be grounded wherever conveniently possible. While one good ground on a system is sufficient, it is always desirable to provide additional grounds wherever a conduit run lies near to or contacts with a steel beam or column, or a grounded pipe. At all combination outlets, that is, at fixture outlets through which a gas pipe extends, the outlet box must be electrically connected to the gas pipe as outlined in rule 28f, paragraph 2.

The sizes of ground wires are determined to a certain extent by the element of mechanical strength; that is, every ground wire should be at least large enough so that it cannot be easily broken, hence, No. 10 B. & S. gage copper wire is the smallest that should ever be used. In case of a ground on a conduit system, as illustrated

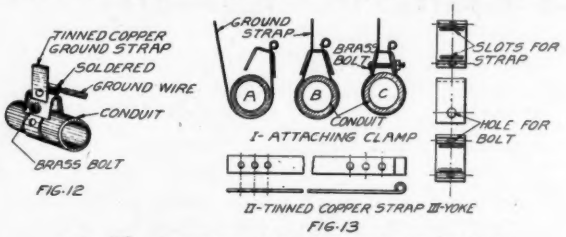


FIG. 12. TYPICAL APPROVED GROUND CLAMP

FIG. 13. CONSTRUCTION AND APPLICATION OF GROUND CLAMP

at N, Fig. 11, II, the ground wire will carry the heavy current for a short interval because the cut-out should operate soon after the heavy current starts to flow; but it is obvious that the current that the ground wire may carry will be determined to some extent by the carrying capacity of the cut-out at M, Fig. 11, II. On a large extensive system it is, then, obvious that this cut-out will be of greater capacity than in a small system; hence, the size of the ground wire should be proportioned with some regard to the size of the largest wire in the conduit system. Copper should always be used for ground wire, because iron wire may rust.

In installing ground wires, mechanical precaution only is necessary; that is, the wires need not be run on insulators, but can be protected by wooden boxing or by molding. The ground wire should not be protected with iron pipe or conduit for the same reasons that lightning-arrester ground wires and the single wire of an alternating-current system should never be run in conduit. Ground wires should preferably be kept away from inflammable materials. Although it is not necessary from an electrical standpoint to insulate ground wires, it is the practice in some localities to run them on porcelain insulators because this often prevents interference by persons who have respect for any electrical conductor carried on porcelain.

Junction boxes should always be accessible both during the construction of the building and after it is completed, so that the wires in the conduit system can be readily removed and replaced. If the junction boxes are not accessible it is apparent that one of the principal advantages of the conduit method of wiring will be defeated. A box is not accessible if it is necessary to remove parts of floor or to make holes in ceilings or partitions to get at it.

There should not be more than 4 quarter bends between outlet boxes. If the route of any run is such that it would necessarily contain more bends than this, accessible junction boxes should be inserted at points in the run so that there will not be more than 4 bends between any 2 outlets.

Wiring Costs

TABLES COMPILED FROM FIGURES OBTAINED IN FIELD OF GREAT VALUE IN MAKING UP ESTIMATES OR EVALUATIONS. BY H. E. WEIGHTMAN

THE FOLLOWING power-plant cost figures, collected by the writer from different parts of the country, will prove valuable to the man required to estimate proposed work or to figure valuation. They are also of use to the electrical contractor.

TABLE I. ELECTRICAL LABOR COSTS FOR STATION WIRING WITH RUBBER-COVERED COPPER WIRE

Size of Wire No.	Labor Cost; per cent of Cost of Material
14	100
12	100
10	80
8	60
6	40
4	30
2	25
1, 1/0, 2/0, 3/0	20
4/0 and cables	18

In using Table I all expensive fixtures, apparatus, etc., are excluded. The percentage given is based on the actual wiring materials, including switches, fuses and cutout boxes. The same figures apply to lead encased wires of No. 6 size and smaller.

Table II gives the cost to install wire and cable in conduit. This figure, one that would be used for such purpose as appraisal, includes labor, contractor's profit

TABLE II. LABOR COSTS FOR PULLING WIRES THROUGH CONDUITS

	Description	Dollars per Foot
1	500,000 Cm. cable in 3-in. conduit	1.820
2	300,000 Cm. cables in 2.5-in. conduit	1.210
2	2/0 wires in 2-in. conduit	0.830
2	1/0 wires in 2-in. conduit	0.620
2	No. 1 wires in 1.5-in. conduit	0.510
2	No. 5 wires in 1-in. conduit	0.260
2	No. 6 wires in 1-in. conduit	0.210

and overhead expense. It will cover feeders, and branches in the usual building work, but should not, however, be used for short lines having numerous outlets.

The average cost of all conduit bends in general wiring practice shows that from 20 to 50-deg. bends cost very closely the same, and that above 50 and up to 90 deg. the bends cost a greater amount. It has been found that the cost of bending is a function of the diameter, and in the usual lengths is independent of the length of the conduit being bent.

Table III gives the labor charges to be added to the cost of the conduit. These costs are for field bending and are quite high when the diameter exceeds about 2 in. In figuring conduit bending to be done on the job, list all bends to be made under 2 heads; 90 deg. and 22.5 to 45 deg. Neglect all bends of less than 22.5 deg., and use about twice the 90-deg. price for bends greater than that amount. Where the conduit is to be bent to a large radius, involving long lengths of pipe and perhaps several fittings, the cost of bending, exclusive of cost of assembling parts, is about 2 cents per lineal foot of bend as a maximum with an average of 1.2 cents per foot for 1¼-in. conduit or smaller.

TABLE III. COST OF BENDING CONDUIT

Size of Conduit, Inches	Dollars per Bend 90 Deg.	22.5 to 45 Deg.
3.0	1.000	0.900
2.5	0.750	0.600
2.0	0.350	0.250
1.5	0.250	0.150
1.25	0.250	0.150
1.0	0.150	0.100
0.75	0.100	0.050
0.50	0.100	0.050

TABLE IV. COST OF WRAPPED CONDUIT

Size of Conduit, Inches	Dollars per Foot
0.5 to 1.0	0.015
1.25	0.019
1.50	0.022
2.0	0.027
2.5	0.032
3.0	0.040

It is sometimes desirable to run a conduit underground between buildings. If, in such case, the conduit is given a good wrapping of tarred canvas, this will more than double its life. The cost for such wrapping, including material and labor, but no pipe or conduit, averages as shown in Table IV.

Experience with Power Plants in Germany

SUPERHEATED STEAM FOR SMALL PLANTS BY B. N. BROIDO

STEADY increase in price of coal, freight rates, and the cost of labor, makes it necessary to study any means by which the efficiency of power plants may be increased at the least expense. One method of obtaining a high efficiency in power station operation is to employ superheated steam.

In a series of articles about his experience with power plants in Germany the writer will also give a brief outline of his experience in changing over boiler plants to superheated steam, giving description of actual results obtained, together with comparison costs. Special attention will be called to the peculiarity of the plant and to changes that were necessary in every case.

Results shown in this article were those obtained at a plant in Germany near Leipsic. The plant had 3 2-flue tube boilers, each of about 120 hp., operated under 150 lb. pressure; 1 2-cylinder—approximately 15 by 23½ by 32 in., 110 r.p.m., and 1 single-cylinder engine approximately 12 by 24, 100 r.p.m., both with poppet valves.

The 2-cylinder engine was situated near the boiler house, and the single-cylinder engine was about 320 ft. away. The steam header was 6 in. in diameter; branch lines feeding the 2-cylinder and 1-cylinder engines were 4 and 3 in., respectively. In addition to supplying steam for the 2 engines, from 600 to 700 lb. of steam per hour was consumed for drying purposes.

Before the superheaters were installed 2 boilers were operated at full load, and the steam delivered was just sufficient to supply the ordinary needs of the plant.

It was decided to change over to superheated steam, which would afford a practical method of operating the present boilers at a greater efficiency and at the same time avoid the necessity of overloading them. Each boiler was furnished with a separate superheater of the uniflow counterflow design, with 380 sq. ft. of heating surface, capable of superheating the steam of the boiler to a temperature of 550 deg. F., when the boiler is operated at its rated capacity.

Date of test	Aug. 5, 1913	Oct. 8, 1913
Duration	5½ hr.	6 hr.
Kind of coal	Pit-coal of	Middle Saxony.
Calorific value of 1 lb. of coal as fired	11,434 B.t.u.	11,386 B.t.u.
Steam pressure by gage	144.6 lb.	144.8 lb.
Force of draft at damper	0.82 in.	0.88 in.
Temperature of water entering boiler	140 deg. F.	141 deg. F.
Temperature of steam	363 deg. F.	548 deg. F.
Superheat	.....	185 deg. F.
Water evaporated per hour	8612 lb.	6924 lb.
B.t.u. added per lb. of water	1085.4	1192.6
Factor of evaporation	1.12	1.229
Equivalent evaporation per hr. from and at 212 deg. F.	9645 lb.	8509 lb.
Coal consumed per hour	1278 lb.	1092 lb.
Water evaporated per lb. of coal	6.74 lb.	6.432 lb.
Equivalent evaporation from and at 212 deg. F. per lb. coal	7.55 lb.	7.91 lb.
Boiler horsepower developed (2 boilers, without superheaters)	279.2	225.
Percentage of rated capacity developed	116.4	94.1
Over-all efficiency of boiler	64.2%	67.1%
Temperature of flue gases leaving the boiler	608 deg. F.	554 deg. F.
Percentage of CO_2	9.6	10.2
Losses through heat in flue gases	24.3%	20.4%
Losses through heat combustible in ashes and refuse	4.1%	4.3%
Losses through radiation, etc	7.4%	8.2%
Steam consumption of compound engine	5527 lb.	4436 lb.
Steam temperature—inlet	360 deg. F.	512 deg. F.
Superheat	.....	152 deg. F.
Horsepower developed	380	377
Steam per hp.-hr.	14.53 lb.	11.73 lb.
Steam consumption of single-cylinder engine	1353 lb.	1070 lb.
Steam temperature—inlet	352 deg. F.	413 deg. F.
Superheat	.....	61 deg. F.
Horsepower developed	61	63
Steam per hp.-hr.	22.2 lb.	16.9 lb.
Steam used for drying purposes, approximately	600 lb.	600 lb.
Condensation of steam in a 300-ft. pipe to single-cylinder engine, per hour	61 lb.	4 lb.
Radiation of heat in this part of piping, B.t.u. per hour	59,170	34,390

ated at rated capacity. The construction of the superheater and the changes on the compound engine will be described in a future article.

An efficiency test was made previous to and directly after the installation of the superheaters. The results are shown in the accompanying table.

As it is seen from the table the steam consumption of both engines at the second test was less than at the first, also the condensation in the pipes became less when superheated steam was used.

The efficiency of the boiler was at the second test greater and the temperature of the flue gases lower, not only because less steam was generated, but mainly because after the superheater was installed the flue gases had a large distance to travel, giving off more heat.

It may be proper here to mention that the steam consumption was less in both engines, but for different reasons. In the compound engine the steam entered with a temperature of about 550 deg. F. A certain amount of steam at 550 deg. F. and 145 lb. pressure occupies 1.3 times as much space as saturated steam, so that with the same length of admission period the same volume of superheated steam enters the cylinder, but its weight is 10/13 that of the saturated steam, while the work done in both cases is approximately the same. This is one of the advantages of superheated steam. The reduction of steam consumption in the compound engine was to a great extent due to this fact.

In a single-cylinder engine there is an additional advantage of superheated steam; that is, it eliminates the initial condensation of steam admitted to the cylinder. The live steam enters the cylinder and takes the same place, occupied shortly before by the exhaust steam, which cooled off the cylinder walls to about the same temperature. Consequently the initial steam (when it is not superheated) condenses when it comes in contact with the cooled walls, the latter becomes moist and this increases the condensation of steam, because the moisture supports the transference of heat from the steam to cylinder walls. Naturally the condensation is higher in an engine of low piston speed, than that in an engine of high piston speed.

It is well known that superheated steam, like a gas, is more unchangeable, and at the same time has a lower conductivity of heat than saturated steam. Entering the cylinder, superheated steam transmits heat to the cylinder walls, but there is no condensation whatever. The cylinder walls remain dry, which diminishes the further transference of heat, so that all initial steam is used to do work. The elimination of the initial condensation is the main advantage for using superheated steam in a single-cylinder engine. The less condensation and radiation observed in the pipes, as is shown from the table, is also on account of the stability and lower conductivity of superheated steam.

The test showed that after the superheaters were installed, at the same factory load, a saving of 1.23 tons of coal was made each day.

The cost of the new installation, including the necessary changes was:

Three superheaters, including erection	5670 Marks—about	$1400
Setting	2400 Marks—about	600
Changes on the compound engine (1 new head and 2 stuffing-boxes for high-pressure cylinder)	400 Marks—about	100
Changing of one part of piping	500 Marks—about	125
Total	8970 Marks—about	$2225

The cost of coal used, delivered to boiler house, was 1.60 marks per 100 kg., about $3.90 per ton, so that the new installation paid for itself in about 1 yr. and 3 mo.

Besides this, the factory was now able to accommodate a larger load should the necessity arise.

In a statement issued recently by Dr. E. E. Pratt, Chief of the Bureau of Foreign and Domestic Commerce of the Department of Commerce, he gives a summary of the present conditions with regard to domestic prosperity and foreign trade. There is much questioning as to just how far the present prosperous business conditions are dependent upon war orders and other temporary circumstances. Dr. Pratt states in part, that all parts of the country are sharing in the advantages of a great production, high prices and increasing profits. Our products, even at the high prices, are in great demand both at home and abroad. Large as has been the increase in domestic trade, it is hardly to be compared with the increase in foreign trade.

Contrary to the idea frequently encountered, increase in the export of munitions has been less than that in the secondary war supplies and in items that have no relation to the war. In fact, the smallest increase in actual amount has been in the direct munitions of war. Furthermore, one of the most important items has been increase in exports to nations outside the war zone. Exports to Canada have increased over 22 per cent; to Central America, 34 per cent; South America, nearly 32 per cent; to Australia, 17.5 per cent; to Africa, 51½ per cent; to Russia, Asia and Japan, 135 per cent. Trade to Europe caused by the war has, of course, increased, but trade with other countries has increased also.

After discussing both the pessimistic and optimistic views of conditions after the war, Dr. Pratt made the following cheerful forecast of what conditions will be in this country. Our economic future rests on the success of our foreign trade, and this, in turn, rests upon our ability to compete in the neutral markets of the world with past and future European competitors. Those American manufacturers and exporters who are in closest touch with present conditions are most confident that we will retain and extend our foreign trade, so that it would seem with proper care and financial, industrial and commercial preparedness, the United States will become the most important factor in world commerce.

We can, therefore, face the consequences of the cessation of hostilities in Europe with courage and optimism founded upon facts. We have an improved scientific banking system which will prevent the recurrence of serious panics, and have established banking connections in foreign countries. We have secured good-will in the markets of the world where formerly United States products were not known and of which we did not know.

GAS POWER APPARATUS

Producers, Engines and Industrial Applications

Gas Producer Control--III*

REGULATION OF GAS QUALITY WITH VARYING LOAD BY EXHAUST GASES MIXED WITH THE AIR SUPPLY. BY REGINALD TRAUTSCHOLD

AS THE FUNCTION of the water vapor in the saturated air method of control described in a previous article is simply to reduce the temperature of the fuel bed, any other heat absorbing medium which will accomplish the same result can be substituted. Based on this principle, a successful producer, the Tait, has been developed which makes use of a portion of the engine exhaust gases to control the temperature of the fuel bed. No water vapor is used in this producer; simply the requisite proportion of the engine exhaust is mixed with the air supply and drawn through the incandescent fuel bed. One of the chief constituents of the engine exhaust, carbon dioxide, tends to promote a negative reaction in the producer, thereby absorbing a certain amount of heat, in addition to the physical cooling effect of the gases.

The first of these processes is brought about by the carbon dioxide combining with the incandescent carbon to form carbon monoxide, just as does the carbon dioxide formed by the first, or positive, reaction taking place in any suction gas producer. The second effect, which is naturally produced by all of the exhaust gases passed through the producer, is but the natural result of passing a medium or lower temperature through the incandescent fuel bed. This absorption of heat by the engine exhaust not only regulates the temperature of the fuel bed, but brings its carbon dioxide constituent to the temperature necessary for its combination with the incandescent carbon.

PROPORTION OF EXHAUST GAS TO PRODUCER

NATURALLY, THE correct proportion of the engine exhaust to use for controlling the producer is important, for it is impossible to secure any sensitive automatic variation of the proportion drawn through the producer with the air supply. In fact, this is unnecessary when once the correct proportion has been ascertained. It is true that under lighter loads the temperature of the engine exhaust will be decreased slightly and for heavier loads increased, but this is immaterial to the efficiency of the function for which the exhaust is employed.

Cooler exhaust means less volume of gas, which is compensated by its increased capacity for cooling and by its slightly greater density; while hotter exhaust, on the other hand, means a greater volume, which is compensated by its decreased cooling capacity and somewhat decreased density. So the comparatively slight variation in the temperature of the exhaust of the engine under varying degrees of load really has no effect upon the efficiency with which a definite part of it can be used as a cooling medium, other than to promote a sensitive regulation of the producer's activity according to the load on the engine. Maintaining constant the proportion of the engine exhaust employed for controlling the producer is the only requisite.

Producers delivering gas of different quality require, of course, different proportions of the engine exhaust for producer control, but there is really little difference between the quality of gas from one producer and that from another and, furthermore, once the efficient and economic proportion has been ascertained for a specific quality of gas, it remains the same for all degrees of load cared for by such gas. In fact, the reliability of this carbon dioxide method of producer control is as great as, if not greater than that of the water vapor method of control. A comparatively dry gas is furnished the engine from the producer, and the exhaust from the engine is also comparatively dry, so that there is little opportunity for variation in the quality of the producer gas.

Conditions governing the proportion of the engine exhaust to pass through the producer are controlled, of course, by the amount of surplus heat which has to be taken up. This, in a well proportioned producer, is about 950 B.t.u., the same as in the case of a producer regulated by the saturated air method. The specific heat of the exhaust gases is about 0.25, their temperature being 400 and 600 deg. F. (204 and 315 deg. C.), and their heat absorbing capacity measured by a rise in temperature of about 3000 deg. That is, 1 pound of exhaust gases from the engine will absorb about 750 B.t.u. in passing through the producer. As 950 B.t.u. have to be absorbed for each pound of fuel consumed, 1.3 lb. of exhaust gases are required for each pound of coal consumed, or very close to 1/6 of the total quantity of exhaust engine gases must be passed through the producer to take up this amount. This is the proportion for which the bypass connection to the engine exhaust should be designed, and will be found to be correct in the great majority of instances. Dampers should be located in the gas pipes, however, by which the proportion bypassed through the producer may be varied to some extent. The best results are secured when the proportion of

*Continued from page 537, June 15 issue.

exhaust gases passing through the producer is the minimum which permits maintaining the carbon dioxide constituent of the producer gas at 5 per cent.

About 30 per cent of the engine exhaust consists of carbon dioxide and this liberates a certain amount of oxygen on combining with the incandescent carbon, decreasing slightly the amount of air which has to be supplied to the producer. The reduction is not great, but is noticeable when regulating the air supply. But from 5 to 5.5 lb. of air have to be supplied per pound of fuel consumed, instead of about the 6 lb. necessary for producers employing the water vapor method of temperature control.

Careful analyses of the gas delivered by producers, both those employing the water vapor and those using the carbon dioxide method of control, show remarkable similarity in the quality of the gases produced under the two methods of temperature control. There is no noticeable difference in the amount of hydrogen or hydrocarbon constituents, which tends to endorse the statement previously made that it is problematic whether any of the water vapor employed for controlling the temperature of the fuel bed really breaks up into its component elements so that the oxygen may combine with the incandescent carbon. Most of the water vapor is probably unaffected chemically and is washed out of the producer gas in the scrubber. The amount of carbon monoxide in the producer gas generated under the two methods of temperature control is approximately the same, as there is no greater supply of carbon under one method than under the other. The proportion of carbon monoxide in the gas from producers employing the exhaust gas control is slightly greater, however, for the proportion and amount of nitrogen present is slightly less, the nitrogen constituent of the engine exhaust no being quite as great as that of air. As the air supply is also reduced in the carbon dioxide control, the proportion of nitrogen is again decreased, though to a lesser degree.

Whether the activity of the producer is controlled by the carbon dioxide or the water vapor system, the economy of operation is almost entirely dependent upon the sensitiveness of the regulation of the producer by the load on the engine. Depending as does the successful operation of any suction gas producer upon chemical reactions, rather than upon those of a physical nature, the control must be extremely sensitive and every care and precaution exercised to guard against mechanical or physical irregularities, if true efficiency is to be realized. A few degrees difference in certain temperatures or but slight errors in the quantities of the materials supplied to produce the chemical reactions may make or mar the success of a suction gas producer as an economical and reliable developer of a valuable and important power gas.

The Diesel Engine*

ESSENTIAL FEATURES OF THIS PRIME MOVER AND ECONOMY WHICH MAY BE EXPECTED FROM IT. SOME USEFUL CONVERSION AND CALCULATING CHARTS

WHILE the first Diesel engine to be built in the United States was completed in 1898, it has only been during the past few years, since the manufacture of this type of engine has been undertaken by a number of prominent American engine concerns, that it has received any considerable amount of attention in this country. The firms which are now manufacturing Diesel engines in this country are, for the most part, either directly allied with foreign companies engaged in making this type of engine, or else they are manufacturing under foreign rights or patents, with the result that they are securing the benefit of the considerable amount of experience which the European makers have had in Diesel engine design. There are now 7 or more firms engaged in the manufacture of this type of engine in this country, in sizes ranging from 50 to 1000 hp.

Among the American makes of Diesel engine are to be found both the vertical and horizontal types, the latter, in a few instances, being double-acting. The use of crossheads and guides has become quite general in Europe for vertical Diesel engines of large size; but in this country vertical units have not been of sufficiently large size to require this type of construction, the simpler and less expensive trunk piston being employed.

For the benefit of those who are not familiar with the principles upon which the operation of the Diesel engine depends, the fundamental conditions of operation, as stated by Dr. Diesel in 1893, will be quoted:

> "(1) The heating of pure air in the working cylinder of the engine by its mechanical compression, by means of the piston, to a temperature far in excess of the igniting temperature of the fuel;
>
> (2) The gradual introduction of the finely atomized fuel into this hot compressed air, and its combustion and simultaneous performance of work upon the out-moving piston;
>
> (3) And (because the fuel can burn only after it has been gasified) the gasification of a non-gaseous fuel, gradually, in the working cylinder itself, in small quantities at a time for each stroke of the piston; the heat for gasification and ignition being obtained from the heat of compression."

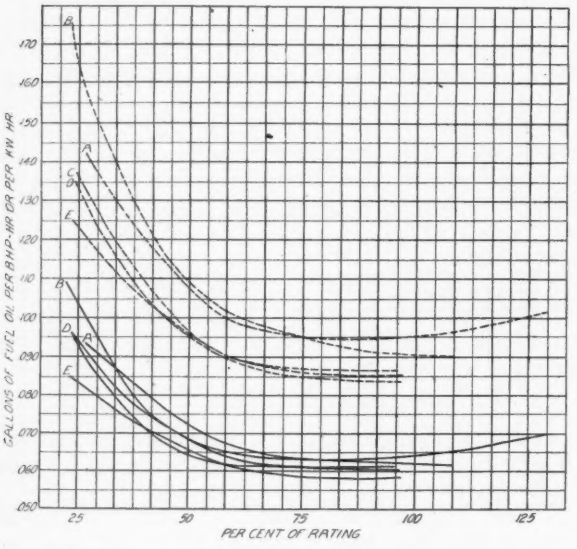
For injecting the liquid fuel into the cylinder of a Diesel engine, air under very high pressure is required. This is furnished by an air compressor, which is driven mechanically by the engine itself, and usually requires some 10 or 11 per cent of the total power produced in the engine cylinders. The pressure of the air varies with the type of the engine and with the load that is being carried. A pressure of about 35 or 40 atmospheres (510 or 590 lb.) is ordinarily required under no load conditions, which is increased to 65 or 70 atmospheres (950 or 1030 lb.) under full load conditions.

In order to avoid the high cylinder pressures which are present in the Diesel engine, the semi-Diesel or low-compression oil engine was later developed. This type of engine occupies a position, as regards cylinder pressures, between the old type of hot-bulb engine and the Diesel

*From a report read before the N. E. L. A., May, 1916.

engine. In the Diesel engine, the entire cylinder volume of pure air is compressed to a maximum of something over 500 lb. The fuel is introduced near the end of the compression stroke, and is gasified and ignited by the heat of compression. The combustion then takes place without any great increase in pressure, but with considerable increase in temperature, during some 10 per cent of the piston stroke, which is followed by a subsequent period of expansion at constant temperature.

In the semi-Diesel engine, the cylinder contents of pure air are compressed to about ½ the pressure usually reached in the Diesel engine. There is usually a small bulb connected with the interior of the cylinder, and this bulb is heated by external means before starting, and by the heat of the previous explosion during running, the result being that the temperature in this bulb is considerably higher than in the main portion of the



FUEL CONSUMPTION TESTS ON DIESEL OIL ENGINES

cylinder. The fuel is introduced at or about completion of the compression stroke either directly into the bulb or auxiliary chamber, or partly into the cylinder and partly into the bulb. The fuel is gasified and ignited by the heat of the air in the bulb, and combustion takes place suddenly and with a considerably greater increase in pressure than occurs in the Diesel engine. In another make of this type of engine, a hot plate is attached to the piston, and the fuel is injected directly into the cylinder against this plate.

While the 4-stroke cycle is the one most commonly used in the Diesel and semi-Diesel engines, the 2-stroke cycle type has been used to some extent principally in marine work, and for very large units. The efficiency of this type of engine is somewhat lower than with the 4-stroke type, due, principally, to the power required by the pump which is used for scavenging the cylinder. The mechanical losses, outside of the pump, are somewhat less in this type of engine, as the result of the use of somewhat lighter moving parts. The mechanical efficiency of the 4-cycle type of Diesel engine, at full load, is probably in the neighborhood of 74 per cent; while in the 2-stroke cycle type of Diesel engine it will not ordinarily be over 67 per cent.

One particular drawback to the use of the Diesel engine in closely settled communities—and this applies as well to oil engines of all types—is the handling and the storage of fuel oil in considerable quantities. Probably all cities and most towns have regulations governing the storage and handling of liquid fuels.

While almost all grades of liquid and semi-liquid fuel —and even powdered coal—have been used in the Diesel engine, the operation of these engines in the United States has been confined almost exclusively to the various grades of what is commonly known as fuel oil. Although coal tar has been used successfully abroad as a fuel for this type of engine, its value for other uses is probably too great in this country to warrant its use as a fuel in this connection. While the Diesel engine will operate satisfactorily on a very wide range of petroleum fuels, in commercial use the range of oils used is ordinarily between 18 and 36 deg. Baumé. In guaranteeing the consumption of fuel at various loads, the Diesel engine manufacturers naturally place some limit upon the grade of oil which shall be used. In the accompanying fuel consumption tables will be found the guarantees of certain American manufacturers of Diesel and semi-Diesel engines, together with the fuel specifications upon which these guarantees are based.

The guaranteed performance of an oil engine is usually given in pounds of oil per brake horsepower-hour, or sometimes in pounds per kilowatt-hour, in the case of an engine which is direct-connected to its generator. As fuel oil is sold at so much per gallon, there is frequently some confusion in converting cost figures based upon the gallon into those based upon the pound. In the Practical Reference Tables are charts which may be used in making calculations of this kind. The first shows the relation between the Baumé scale and the specific gravity scale; the second provides means for finding the number of pounds per gallon and the number of gallons per pound for any oil of known specific gravity, at 15 deg. C. (59 deg. F.); the third shows the relation between the price of oil per gallon and the price per pound for oil of different specific gravities; while the fourth provides for finding the fuel cost per kilowatt-hour when the grade of oil, its cost per gallon, and the guaranteed fuel consumption per kilowatt-hour are known.

The accompanying curves are the results of several fuel consumption tests upon Diesel engines. The lower full line curves show the consumption of fuel oil per brake horsepower-hour; while the upper dotted curves show the consumption of oil per kilowatt-hour.

As a general statement, it would appear that the fuel consumption in a Diesel engine plant of medium size is approximately 1/10 gal. per kilowatt-hour, with a fuel cost ranging from 2 to 4 mills per kilowatt-hour, depending upon the price per gallon paid for fuel oil.

The cost of Diesel engine units, complete, with generators and all auxiliary equipment, will ordinarily range from a little over $100 per kilowatt in very large plants, to about $150 per kilowatt in small plants, the cost varying, of course, with the number and size of the units, the location of the plant, etc.

LETTERS DIRECT FROM THE PLANT

Cash Paid For Ideas Accepted. Sketches Desirable.
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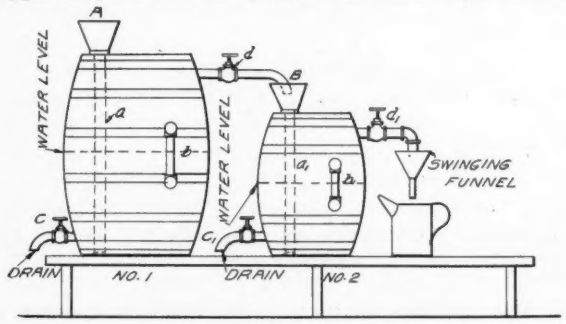
Homemade Oil Filter

NOT LONG AGO I was holding down a job which called for great ability, as you will readily see when I tell you that I was chief engineer, oiler, coal and ash passer, besides being head (and tail) of the repair and maintenance department.

The boss made no bones about stating that I was expected to produce 20 per cent at least above the (ice plant) rated capacity, as he had been assured (when purchasing) that this was as easy as rolling off a log; also, I was to cut down the coal consumption considerably and if I got along well he might let me pull ice while I was resting.

My predecessor had been so busy hauling domestic coal (while resting) the winter before, that little if any repair work had been done, and as the ice season was at hand I had little opportunity to look over the bearings and brasses of the machine. Most of them had apparently been hot the previous season and (as I found



OIL FILTER MADE OF BARRELS

out later) had no oil grooves so that since I was crowding the machine to get that 20 per cent increase in capacity, nearly everything about it was hot continuously and required great quantities of oil.

This was soon observed by the office and I was requested to explain why, with a machine that had been thoroughly overhauled (?) the previous winter I was using so much more oil than they had the previous season. It was no use to explain to a man who didn't know a crosshead from a cylinder head; and as my suggestion that an oil filter be purchased was coldly turned down, I decided I would have to get busy on some scheme to save the waste oil.

We had some empty oil barrels and half barrels on hand, so I took one 52-gal. bbl. and one 33-gal. bbl. and made an oil filter.

Referring to the accompanying sketch, A is a common tin funnel about 10 in. in diameter with 4 thicknesses of gunny sacking for a strainer to catch bugs, sticks and large particles of dirt in the waste oil; *a* is a 1¼-in. pipe which extends from the funnel to within an inch or two of the bottom of the barrel; *b* is an old water glass and valves by which the level of the water in the barrel can be ascertained. The drain valve C is used to keep the water at its proper level. Valve *d* and pipe is where the oil overflows to funnel B, which has first a piece of cotton flannel, then a chunk of waste and over that another piece of cotton cloth. The fittings on the second barrel are the same as on the first.

The process is as follows: Dirty oil is poured into funnel A, goes down pipe A up through water, separating from its entrained water and dirt, then overflows through valve and pipe *d*, goes down through cloths and waste in funnel B, down pipe a_1 up through water in barrel 2, disposing of most of the remaining dirt, and is then ready to overflow through valve and pipe d_1 into a swinging funnel, with cloths and waste in it; after passing through this, the oil was caught in a gallon measure and used in the hand oiler.

This method is somewhat crude, but where the company will buy nothing, and yet expect first class savings, it will help. The complete cost was 2 funnels, 35c (the third was on hand); cloth, 10c, and what the barrels would have brought had they been returned to the oil company, viz.: 90c and 55c, which gives a total cost of $1.90. Nearly any plant has old valves, pipe and fittings required, which can be advantageously used.

The whole job took about 2 hr. and after I completed it, the boss said: "Well, 'we' did pretty well when 'we' thought of that." R. B. C.

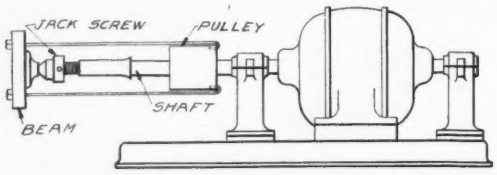
Removing a Tight Pulley

UPON TAKING CHARGE of my plant I discovered that the 100-kw. generator belted to the engine making 95 r.p.m. was running at an excess speed of from 75 to 100 r.p.m. With light load I could slow down the engine so as to run the generator at proper speed, but when the peak came on I experienced considerable trouble.

After much pleading I convinced my employer that the only proper and permanent remedy was to use a 22-in. pulley on the generator shaft instead of the one then on, and in that way run both engine and generator at all times at constant speed.

The new pulley arrived and all was in readiness to make the change when it was found that the old pulley would not come off as easily as had been anticipated. After many unsuccessful attempts to remove this old pulley, I took 2 iron rods threaded at one end and hooked at the opposite end, a heavy timber and a jack screw

and arranged them as shown in the accompanying figure. The threaded ends of the rods were passed through holes in the timbers while the hooked ends were slipped over the rim of the pulley. Nuts and washers were then placed on the threaded ends of the rods and the nuts drawn up so that the pressure exerted held the jack screw in place between the shaft and the timber. Taking up on the jack screw would not move the pulley, however, until we began to play the flames of large



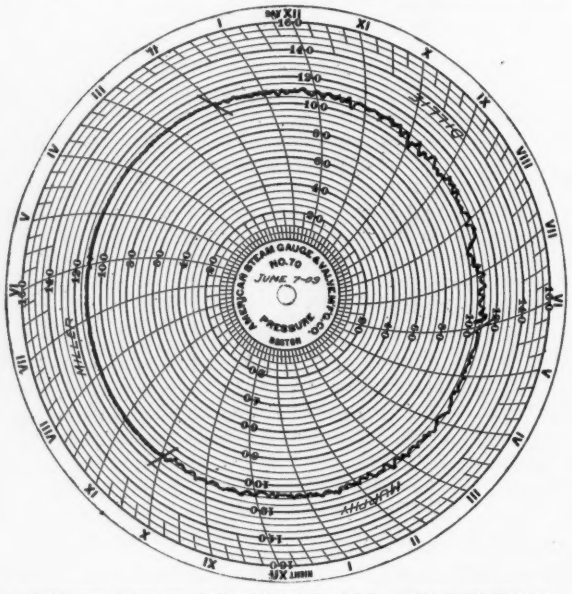
PULLEY READILY REMOVED WITH JACK SCREW AFTER HEATING HUB

blow torches upon the hub. The first move of the pulley was about ¼ in., after which it was readily removed by taking up on the jack screw and continuing the application of the heat.

Since the new pulley has been in service and the generator run at proper speed, the belt rides smoother, the bearings run cooler and above all less coal is consumed with a greater power output. G. H. Brough.

Firing Record

Herewith is a record of 24-hr. firing taken at an Ohio institution when I was employed there as a fireman and substitute engineer. We made all our firing records along this order and you will notice the rivalry among us. When gas was used under the boilers at the



PRESSURE RECORD SHOWING RIVALRY AMONG FIREMEN

plant I tried to equal my record with coal, but I never could with gas. The boilers were of the Atlas water tube type of 300 hp. each. The load varied greatly. At 4 p.m. the shops shut down for the day and at 7:30 the light load was put on until bed time at 9 p.m., when all cell lights were thrown off. Live steam was used for heating the dish water, boiling coffee and various other things, causing a variation of steam consumption. Slack was used for firing and I had the boiler supply pump to look after, tend my own water, a house supply pump, also a deep well pump. I began to clean fires at 5:45.

The boiler plant was equipped with 4 Atlas water tube boilers, 2 being fired at a time, hand firing being employed and no draft regulator being installed. I went on duty at 2 p.m. and was relieved at 10 p.m.

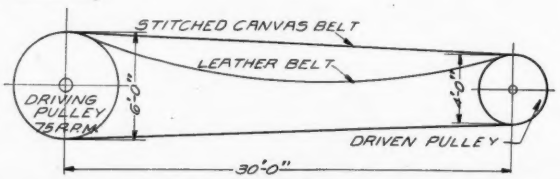
Carl F. Miller.

Some May 1 Letters Discussed

On page 420 of the May 1 issue, J. P. Lisk omits to mention the necessity of blowing through newly erected steam lines, prior to making connection with the engines. Much grease and rubbish, waste, chips, and frequently bolts and small tools, are removable from the line by no other means.

I also make a point of blowing through the steam ports of engines newly erected, before putting the valves in place.

New boilers frequently yield a rich harvest of bolts, punches and general debris. I once took charge of a plant whose boilers were about 8 yr. old. The previous incumbent vouched for their good condition, on the strength of periodical inspections made by himself; yet I found one of them to contain a 6-lb. sledge hammer, 2 wrenches, 8 lb. of ¾-in. bolts, an assortment of nuts and washers, a pair of pants and a screwjack. How or why this extraneous matter got in, and having gotten in was neither removed in cleaning, nor drawn into the blowoff line in blowing down, is wrapped in the mists of obscurity.



SUGGESTED IMPROVEMENT FOR REINFORCING LEATHER BELT WITH CANVAS

The belt drive shown by N. G. Near on page 424, is subject to improvement by running the inner belt very slack, as shown.

The function of the outer belt is to afford an increased factor of adherence between the inner belt and the pulley surface; the former belt should therefore be fully as wide as the latter.

Mr. Merrill's letter on page 426, in regard to the inefficacy of molasses as an engine lubricant, calls to mind a certain boiler feed pump, which refused to budge for love or money. Steam, crowbars and cuss words availed not. A small modicum of kerosene oil was fed through the lubricator, and lo, what a change! Investigation proved that a young oiler had substituted boiler compound for cylinder oil, and had been feeding the pumps on this diet for a week.

R. C. W., on page 430, shows a case of bent stay rods, which came to that condition from the following cause:

A hot fire was built under the boiler, when filled with warm or cool water. The tubes and shell suddenly heated, expanded probably ½ in. The stay rods remaining cool did not expand, but were elongated a pro-

portionate amount. Being ductile the stay rods readjusted their length to the new conditions. Subsequent cooling and contraction of shell and tubes, caused the now lengthened rods to buckle.

R. C. W. was ill advised to take up the apparent discrepancy, as the occurrence would then only be repeated, to the detriment of both boiler and stays. This fact is clearly demonstrated in his statement, following the alteration, the girth seam developed a leak.

H. K. SCHOLEFIELD.

Where Forced Draft Failed

I WAS INTERESTED in the article by A. N. R. in the May 15 issue, showing failure of a forced draft system as applied to a 66-in. horizontal return tubular boiler in a laundry plant. The article would have been more interesting had the writer given his opinion of the cause of failure.

It seems to me that the possibilities for good economy with the outfit are great when properly handled, and that this would have been a good opportunity to demonstrate the worth of an Orsat apparatus, as the author states that by stopping the fan and using natural draft a saving of ½ ton of coal a day was made, which leads to the conclusion that the outfit was furnishing too much air. An Orsat would have shown this condition if it existed and would also have shown the way to better economy than could have been produced with natural draft, as an increase of 10 deg. in the temperature of the air should result in 1 per cent increase in efficiency, and judging from the looks of the layout, it should result in a considerable increase in temperature of the air.

Possibly the pipes became buried in the fine ash that accumulates in such places, in which case a change of location would be desirable. Installation of a control valve for governing the speed of the fan would no doubt have been beneficial and had the fan intake been piped from the upper part of the boiler room instead of through the wall, as shown, better results would have been obtained, as air would have been drawn from the warmest place; this would have resulted in a gain in economy approximately 1 per cent for each 10 deg. rise in temperature of the intake air. C. B. HUDSON.

Blowing Boiler Tubes with Air

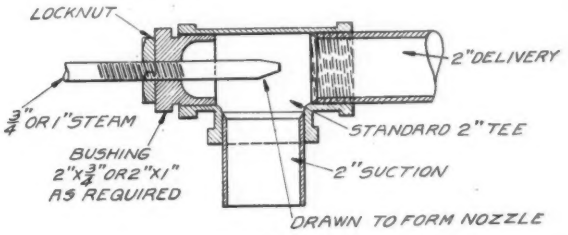
IN THE June 15 issue, J. C. Hawkins names some objections to the use of air for blowing boiler tubes.

I wish to add another objection—temperature. When air is taken from a tank of compressed air, its temperature is about the same as that of the surrounding atmosphere; but it is well known that on expansion air cools, and we therefore have a "cold jet" of air impinging on a hot boiler tube, which is surely bad practice. True, if the air is first made to pass through some heating coils before it is allowed to come in contact with the flues, that objection would be removed.

Even where steam is used, the temperature of that steam is usually less than the temperature of the tubes, and the steam is taken from the very same boiler onto which it is blown. According to my way of thinking, the cleaning blast should be "warmer" than the tubes themselves, but I do not know of any case where such practice is followed. Usually, the temperature of the blowing medium is colder. N. G. NEAR.

Criticism of Diagrams; Homemade Ejector

THE DIAGRAMS from the 20 by 20-in. engine, reproduced on page 471, of the May 15 issue, show that the length of the valve stem is wrong. It will be observed that admission, cut off and release are all earlier on one end than the other and compression is not the same on both ends. To correct this, change the length of the valve stem until the admission lines both have the same general shape, and it will be found that the other points have also been corrected.



PROPORTIONS OF SUCCESSFUL EJECTOR

On page 467, J. M. Row gives some experience with ejectors made of pipe fittings, and I do not quite agree with his system. Herewith is a sketch of an ejector I have made of all sizes from ¾ in. to 3 in. and have lifted even hot water with them.

End of steam line should be drawn to form nozzle, with hole in end ½ in. in diameter. Steam line should also have a long thread cut on it and lock nut as shown; this is to provide means for adjusting and securing the point of nozzle in correct position to suit condition of steam pressure and lift. H. W. BENTON.

FOR ELECTRICAL INSTALLATIONS contracted for after June 30, 1916, on all vessels coming under the jurisdiction of the Board of Supervising Inspectors of the United States Steamboat-Inspection Service, the following specifications have been approved by the Secretary of Commerce:

The installation must be in keeping with the best modern practice, wires being run in approved iron conduits, armored casing, or molding. Iron conduit or armored casing shall be required in bunkers, cargo spaces, store-rooms, and all places where the leads are liable to mechanical injury. Wires led through beams, frames or nonwater-tight bulkheads, shall be carried in iron conduits, armored casings or protected by hard rubber or equivalent bushings. When carried through water-tight decks or bulkheads, wires must be provided with a suitable stuffing-box at the deck or bulkheads, and if liable to mechanical injury, must be protected by suitable boxes or cages.

In locating the system, care must be taken to provide accessibility for examination and repair, and especially to avoid any arrangement which may permit the lodgment of standing water. All taps, joints and splices must be fitted with water-tight junction boxes, and joints must be so spliced as to be both mechanically and electrically secure without solder, then soldered, properly insulated and protected by waterproof tape.

Any changes or alterations in electrical installations of vessels now in service must be in accordance with the above specifications.

Questions Answered and For Answer

Expert Help When In Trouble. If You Want Quick Answer Enclose a Stamp

Power Plant Questions and Answers

WHAT SPECIAL PRECAUTIONS would you take when laying up a boiler, such as the Stirling or the B. & W., for an indefinite length of time?

A. Before emptying a boiler which is to remain idle for an indefinite period, several gallons of crude oil should be placed in the shell or steam drum so that when the blowoff is opened, the oil will form a light covering over the tubes and inside surfaces of the shell. Before the boiler is used again, this oil must be removed with soda ash. Dry the boiler thoroughly when emptied. Clean off all accumulations of ash and soot with a scraper or wire brush and give the exterior of all tube and shell surfaces a coat of boiled linseed oil. Smear all brass or finished work with vaseline slush or a mixture of white lead and tallow.

2. What is meant by wiredrawing and in what engine does this occur most frequently?

A. Wiredrawing is the term applied to any cases in which the steam pressure is reduced owing to insufficiency of valve opening. Steam is more or less wiredrawn in all engines fitted with plain slide valves, due to a slow movement of the valve when opening and closing the ports. With Corliss and other releasing gear engines, the valve movement at cutoff and release is very rapid and wiredrawing slight.

3. In a riding cutoff engine, has the rider the same throw as the main eccentric?

A. The rider will have the same travel as the main valve.

4. If you desired to obtain earlier release and more compression in a single eccentric Corliss engine, what changes would you make? Would such changes affect the range of cutoff?

A. To obtain an earlier release and more compression, the eccentric must be advanced on the shaft to cause the exhaust valves to open and close earlier. This change will not change cutoff, but admission will be earlier; to correct this, change length of steam valve rods.

5 and 6. How much clearance is generally given a steam engine?

If you had a high-speed engine and a low-speed engine, which would you give the more clearance and why? How much clearance would you give?

A. Clearance in a cylinder is the space allowed for the piston to clear the cylinder heads at the end of a stroke. It also includes the volume of the steam passages or ports between the cylinder and the valves. Clearance is employed to prevent the piston from striking the cylinder head. The steam in the clearance space also acts as a cushion in bringing the piston to a stop at the end of the stroke.

The amount of piston clearance given a steam engine depends upon the design of the engine. Stated in terms of percentage of stroke, it may range from ½ to 1 per cent in a slow-speed engine, such as the Corliss, to 14 per cent in a high-speed engine.

7. How would you start an engine having a dependent condenser?

A. In starting an engine with a dependent condenser, the exhaust steam must escape to the atmosphere until the engine has attained normal speed. With condenser then operating in good order, the exhaust may be diverted to the condenser.

8. Is it necessary to block up the governor when setting the valves of an engine? If so, why? In what position would you block up the governor of a Corliss engine? On a shaft governor engine?

A. In setting the valves of a Corliss engine, the length of the eccentric rod, hook rod, steam and exhaust rods and dashpot rods is first adjusted, then the governor is blocked up halfway and the reach rod levers are fastened at right angles to a line drawn halfway between the 2 rods. The length of the reach rod is adjusted until the knockoff arm stands vertical. The engine is turned over until cutoff occurs and the distance that the crosshead has traveled is measured. Then with the same distance on the other side, the length of the reach rod is adjusted until cutoff just occurs. This insures equal cutoff at each end of the cylinder.

In an engine with a shaft governor, the governor is usually blocked out to a position to give the desired cutoff. If the governor is so made or located that it cannot be blocked out, the setting may be made with the governor at the innermost position, as the division of lead between the ends is not greatly altered by the change of position of the governor, and the exact division of lead for the best action can be determined from the indicator diagrams.

9. What is the weakest part of a vertical fire-tube boiler? Why?

A. The longitudinal seam is the weakest part of the boiler, due to the number of holes drilled in the shell for rivets.

10. Explain the operation of the automatic injector. Of a Hancock inspirator.

A. The automatic injector has a movable part, which, as the steam jet gets into action and creates a suction between the forcing tube and the lifting tube, is drawn up and closes the outlet to the overflow. Until this suction is formed by the action of the steam and water jet, the movable piece will rest, so that the water will escape from the overflow. In case the stream into the boiler breaks for any reason, the movable piece

will drop back and water will again escape from the overflow until the jet is established.

The Hancock inspirator is a double-tube injector. One tube is used for lifting the water, and the other for forcing it into the boiler.

11. Why have not small boiler feed pumps, flywheels and steam ends similar to small steam engines equipped with automatic cutoff valves?

A. An ordinary boiler feed pump operates against a boiler pressure and head which are almost uniformly constant. It is necessary, therefore, that a constant steam pressure be applied to the steam piston throughout the entire stroke, in order that the feed water may be forced into the boiler. As the effective pressure on the piston remains constant, no intermediate cutoff is used, consequently no flywheel is employed to store up and uniformly distribute power as is required in an engine with an expansion stroke.

12. Before placing new piston rings on a solid cylinder, what precautions would you take? How would you put in the snap rings? How would you measure for the ring?

A. Before putting in new piston rings, they should be tested in the cylinder to make sure that they are of the proper diameter, and should also be tested in the grooves to make sure that they are a free fit sidewise but not too loose. This can be done by sticking the ring into the groove and rolling it around to be sure that there is no binding at any point of the ring.

To put a set of snap rings on a solid piston, it is necessary, of course, to take the piston out of the cylinder. Then the rings are opened up sufficiently to let them pass onto the piston, and are pushed along until they slip into the grooves.

If it is necessary to pass a ring by a groove, this may be bridged at a number of points with strips of thin sheet iron, so that the ring will slide over to the groove beyond without dropping in. The same method may be employed to remove the old rings; that is, spread them out and slip thin strips of metal underneath, so that the rings will be held out of the grooves and may be slipped from the piston.

13. How many ports has the steam end of the Deane of Holyoke simplex pump? What is the purpose of each of these ports?

A. Deane of Holyoke simplex pumps have either 3 or 5 ports, depending on whether the type is tappet motion or lever motion. The tappet motion pump has 3 ports and the lever motion pump has 5 ports. Where 5 ports are employed, the 2 outer ports are for the admission of live steam and the 2 inner ports carry exhaust steam to the central exhaust port.

14. With equal areas, why will a direct spring-loaded valve care for more grate area than one not so loaded?

A. In the spring loaded or pop safety valve, a ring surrounds the valve disk, preventing it from discharging until the valve has lifted somewhat.

As soon as the valve begins to discharge, there is an additional rise due to the force of the steam rushing up against the increased area of the bottom of the valve and holding it open until the pressure has dropped a trifle below that at which valve began to discharge. This difference in pressure is the reason that the pop valve will take care of more grate area than the dead weight or lever valves, as the presence of the lip or ring virtually increases the normal area of the valve when the valve is discharging.

15. Is the available cutoff of a common slide valve engine fixed? If so, what is such limit?

A. In a plain slide valve engine, the cutoff is limited by the design of the valve. If the steam lap is made small, the cutoff occurs late and vice versa. It may range anywhere from 5/8 to full stroke.

16. What is the difference between barometric, siphon and ejector condensers?

With these types of condensers, can the water return to the engine?

A. A barometric and siphon condenser are virtually the same in operation. In both of them, the suction is secured by the use of a long tail pipe, extending downward from the condenser head, which is used to create the vacuum. Sometimes this suction is used to pull up the cooling water from a lower level, sometimes the water is supplied to the condenser head by a pump; but, in any case, the cooling water and the condensed steam are carried away by the suction of the falling column of water on the tail pipe.

In some recent types, the suction has been produced by pumps attached to the end of a short tail piece, instead of using a pipe long enough to give the suction by the falling of a column of water, and this becomes an ejector type of condenser, which has no particular advantage over the ordinary jet condenser.

A barometric condenser is usually set so that the condenser head is higher than the low pressure cylinder of the engine. If for any reason the water in the condenser head rises too high, cooling water will flood over into the low-pressure cylinder. A vacuum breaker should be installed to break the vacuum and prevent flooding should the water rise too high. Water may return from the siphon and ejector condensers under the same conditions.

17. Are Worthington condensers provided with vacuum breakers? A. No.

18. What are the advantages and disadvantages of high piston speed as compared with low piston speed?

A. A high piston speed gives high power for a small engine, thus reducing first cost, and also decreases the initial condensation of steam as it enters the cylinder. High-speed engines are well adapted for direct connection to an electric generator, and take up less floor space than a low-speed engine. The chief disadvantage of high speed is the resulting wear and tear upon the engine parts. W. P.

Preventing Absorption of CO_2 Gases by Use of Salt Water

I AM DESIROUS of arranging a system for collecting a continuous sample of flue gas and have read that charging the water used in the bottles with salt would prevent the absorption of CO_2 gas by the water. Is this true? I am in a position to obtain distilled water quite readily and would like to inquire if this would be preferable to raw water for the purpose named.

C. B. H.

A. We do not believe it would be advisable to use distilled water in the collecting bottles for your flue gas, as this would have much more tendency to absorb the CO_2 than would ordinary water.

As a matter of fact, ordinary water or cistern water has taken up from the air about all the CO_2 it will hold, and will become saturated after use for a few tests in the apparatus.

We are not sure whether the use of salt will further prevent absorption or not, but presume this might be the case, as the saturation of the water with any mineral tends to reduce absorption of other substances.

We have never, however, found it necessary to use anything other than ordinary tap water in this apparatus, and the results will check for test after test, showing that there is no great amount of error. A. L. R.

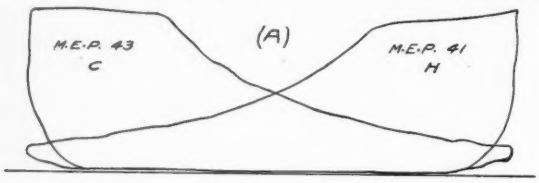
Indicator Card Criticism

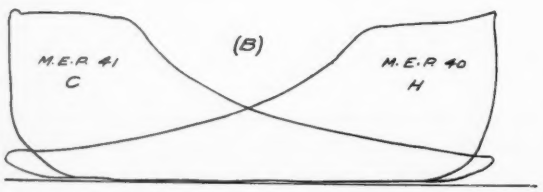
WE HAVE just had a new cylinder added to our engine which is rated at 250 hp. when running at 80 r.p.m. under a steam pressure of 100 lb. gage, but are not satisfied with the way things are running.

The 2 cards shown in the accompanying illustration were taken by the erecting engineer. What is the cause of the drop along the admission line of the head end? Is the engine overloaded according to these cards?

J. D.

A. The cards you have submitted for criticism are far above the average, and there seems to be little the matter with them, on the whole. While you do not say





INDICATOR CARDS TAKEN AFTER ADDING NEW CYLINDER

so, we believe that the cards are from a Corliss engine, which most likely has but one eccentric. This being the case, some of the fine points will have to be sacrificed in order to carry the load and still cut off at a reasonably early point in the stroke, unless the conditions as shown in the cards can be improved a little, as will be shown later.

If the 2 cards are a fair average of the working conditions, as shown by a series of cards taken during a wide range of load conditions, you "scrimped" a little on several things, when you put on the new cylinder, as cutoff now takes place at about 28 per cent of the stroke, which gives a correspondingly high terminal pressure. Best results are obtained with a cutoff of about 22 to 23 per cent of the stroke. But, as you cannot change the cylinder for one an inch or 2 larger in diameter, then either increase the boiler pressure to about 105 to 110 lb. gage, or else increase the speed of the the engine to about 90 or 92 r.p.m. You will notice that on the card marked (A), the steam pressure is but 90 lb. and that the point of cutoff is perceptibly later than it is on card (B), where the steam pressure is but 4 lb. higher. Working this problem backwards, brings us to a point where we will develop the same horsepower as at present at approximately 22 per cent cutoff with from 105 to 110 lb. pressure. If, for any reason, the pressure cannot be raised, raise the speed either by placing a larger pulley on the governor or a smaller one on the shaft; the former plan is generally followed, for obvious reasons. Find the number of revolutions per minute of the governor as the engine now runs, and then calculate what changes in pulley dimensions will have to be made to bring the engine speed up to about 90 r.p.m., for the governor speed never changes.

We believe that with a change such as has been suggested above, the engine will exhaust its steam a little freer, and do away with the back pressure, or at least some of it. We would suggest also that you reduce the exhaust lap a little, which would make release a little earlier, and compression a little later. You have too much compression for the speed and pressure at which the engine is running.

The cards develop 216 and 224 i.hp. respectively; cutoff is a little later at the crank end, but let that stay, as the piston rod takes up some of the area on that side of the piston.

The drop in the head end card shows tardy transmission. G. H. WALLACE.

Releasing Elevator Car

HOW WOULD you proceed to release an elevator car after the safety has acted and the car is hanging on the safety cable or device?

2. In the drum type of electric elevator, are the counter weights placed above the drum weights, or are the drum weights placed above the counter weights?

J. B.

ANSWERS

IN CASE the safety has acted and has stopped the car, it is of the greatest importance to see, before unlocking the safety, that there is no slack in the hoisting cable. Should there be such slack, carefully take it up, reversing the motion of the motor and running it slowly. In hydraulic elevators, this can be done generally by carefully opening the controlling valve. In electric elevators, it is better to turn the worm shaft by hand.

After the slack has been taken up, unlock the safety catches. Most safeties are so arranged that they unlock automatically when the car is moved upwards. In the Otis gravity wedge safety, the wedges will drop back by gravity. In some makes of cars, the governor rope will automatically release itself while the car is going up, but the tripping device must be readjusted by hand. A hole in the car floor is provided for that purpose.

In case the car has been stopped above the top landing, it may become necessary to remove the limit stop button on the shipper rope, so that the car may be raised high enough to unlock it. If this should become insufficient, it may even be necessary to raise the car by means of a tackle.

2. In the drum type of electric elevator, we usually find the counter weights placed above the drum weights.

O. H. H.

Operation of Storage Batteries

I OFTEN GET 3-cell batteries with one dead cell; that is, there will be 2 cells completely discharged, testing about 1100 specific gravity, and one cell entirely dead, showing no amperes or volts on the meter. What is the cause of this dead cell and how should it be treated?

2. We have a 12-cell battery here which, when brought in, had 7 dead cells, the other 5 being just barely alive. After putting in a new solution of acid, testing 1300 specific gravity and charging for 40 hr., the voltage was up to 2 v. per cell and specific gravity test was 1300. The battery stood idle for 10 days, when, upon examining it, I found 6 cells dead and the rest more than half discharged. Will you kindly tell me the trouble and whether or not it can be repaired? I noticed when pouring the old solution out of this battery that it was a rusty red in color. I have had several batteries with the solution colored like this. Can you tell me what causes it?

3. I notice it is common practice for car owners and garage men to take a discharged battery, pour out the solution, refill with new electrolyte, replace the battery in the car and after charging it for one or 2 hr. with the generator in the car, put the battery in regular service. Is this injurious to the battery? If so, what does it do to it?

4. What is the length of life of a battery doing regular work on a car, that is, operating starter and the lights?

A. J. B.

ANSWERS

A DEAD CELL in a 3-cell battery is usually due to buckling and sulphating. As you are probably aware, in these small batteries, the plates are very thin and are separated by wood separators. These separators, because they are very thin and are immersed in an acid solution, are likely to rot, particularly if they are not covered with solution all the time. In such a case, the plates may touch each other, which results in short circuit inside the cell and immediately runs down that cell. The heavy over-discharge causes swelling of the active material in the plate, and this results in warping and buckling, usually also in sulphating,—that is, a chemical change which produces a white coating that settles to the bottom, or creeps around the edges of the plate and short circuits all of the cell.

The only thing that can be done is to take this cell out of the battery box, take it apart and, if the material is not too badly broken to pieces, the plates can be thoroughly washed and cleaned, then put flat boards between the plates, treating each set separately, and squeeze these in a vise or large clamp to straighten out the plates. The plates can then be put back into the cell, after putting the proper wooden separators between them, and charged slowly for a long time, at low current, until the cell gases freely. If it seems to be all right, it can then be put back into the battery case and connected up as usual. The whole process requires careful treatment, and is usually not worth while unless the plates appear to be in good condition, and the active material hard and firm in the plates. In most cases, if the cell has been dead for some time, it is cheaper to throw away the plates and put in new ones.

2. Probably the same difficulty existed in the dead cells in your 12-cell battery,—a short-circuited or sulphated condition of the dead cells, not quite as bad as in the other case, but sufficient so that, while the batteries would take charge, they would soon run down from leakage inside the cell. The only safe thing to do here is to take down the entire battery and go over the cells one by one to make sure that they are in proper condition, then give them the same treatment as outlined above.

The rusty red which you noticed in your old solution is simply the particles of the red litharge which have scaled off from the positive plates and dropped into the bottom of the cells. This does no particular harm as long as there is not enough sediment in the bottom to form a short circuit between the bottom of the plates; but in using the solution over again, it should be allowed to stand until it settles out clear, and then only the clear portion poured off from the top, being careful not to disturb the settlings.

3. The treatment that you mention of washing out a discharged battery and putting it back immediately into the car, is bad. A discharged battery, if it has recently been cleaned and filled with solution, can be recharged on a charging table to full capacity and then put back into the car. If it has been a long time in use, it is best to take out the solution, wash the cells with clear water, fill with fresh solution, using so much of the old as can be taken off clear without any sediment, then put the battery on the charging table and charge it up to full capacity before putting it back into service.

The danger of running a discharged battery is that it will sulphate, particularly if allowed to stand for a long time idle with the battery nearly or fully discharged. This sulphating will cause the accumulation of so much of the sulphate as to produce short-circuiting, and in any case, will tend to warp and buckle the plates.

4. The time that a battery will last depends almost entirely on the use that a car gets. If the car is used for "running around," so that the starter and lights are used a good deal, and the charging periods are comparatively short in service, the battery will be in a partly discharged condition a good share of the time, which will considerably shorten its life. If the car is used largely for long trips, so that the starter is used infrequently, and the car does not stand for any long periods, repeatedly, with the lights burning, the life of the battery will be greatly increased. With average use that a car gets,—if the battery is kept with the solution at the proper height, covering the plates, and care is taken to see, by tests, that the voltage is kept up nearly to full charge,—a battery should last 2 or 3 yr. If the battery is abused by letting the solution run low, by letting it stand, particularly in cold weather, nearly discharged, it is not likely that it will last more than a year. A. L. R.

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Hiring For or By the Chief

Development of welfare work in many large industrial plants has tended, in some cases, to withdraw department heads somewhat from the close contact formerly maintained with the problems of employment. The chief power plant engineer is logically a department head, and as such has undoubtedly felt the effect of this change in practice in numerous cases where he is properly entitled to have at least a voice in the selection of new employes. Without criticizing the prevailing tendency toward selecting new men after very careful scrutiny of the physical and mental fitness for service, coupled with a thorough examination of their previous records, it is none the less worth while to urge that enthusiasm for social welfare work be not permitted to debar the chief plant engineer from a share in the hiring of subordinates.

It is certainly not going too far to say that the chief should have the opportunity to pass upon all candidates for service in his part of the establishment, in works where such candidates go through the routine examinations now common in highly developed organizations, and if he concludes that the prospective employe is not suited to the job, is it asking too much that he be given the right of appeal to the superintendent or manager from the employment department picking? We think not, and we go so far as to assert that if an undesirable subordinate is forced upon the staff against the chief's wishes, in a case where it is clear that no personal feeling enters the decision, it is sufficient cause for the chief's resignation, if he sees the matter in such a light. No executive can shoulder his responsibilities properly if he is not sustained in the selection of his subordinates, assuming a full and clear presentation of the facts to those above him.

Again we assert that we have no quarrel with the selection of men by a special bureau except to point out that cast-iron restrictions should not be placed forever and always upon the methods of hiring, for there are times when it pays to cut red tape and seize the opportunity to employ the best available men for the work. Thus, the chief engineer may know just the man in another place to round out his organization and to strengthen it. Such a man, who may be a near-genius, for instance, in the adjustment and maintenance of water-wheel governors, may fit into the system's needs better than any one of a hundred applicants sent from the employment department, and we maintain that in such a special case, for good and sufficient reason, it should be regarded as possible and proper to set aside the ordinary regulations of the bureau which receives and acts upon applications. Doubtless the reader is saying to himself, "In my plant the chief engineer has the opportunity to pass upon every application for service within his department, as a matter of course, and therefore he has no kick coming." There are times, of course, when the engineer must be content to be over-ruled for good and evident reason; but in general he should be "the doctor" in these matters, when it comes to final decision.

Power plant work is highly specialized, and more than this, it is one in which intimate relations are generally fostered among the staff. It is very different

work from that performed 8 or 9 hr. a day at a machine tool, and whatever the necessities of organized selection from shop applicants, it is not too much to urge that at least the right to appeal to higher authority be admittedly the chief's, when additions are made to the working personnel. After all, no matter how bureaucratic an employment department is, it exists only for the benefit of the establishment, and while the maintenance of strict rules and regulations in general is fair, there is no fundamental reason why the best solution of an employment problem should be foregone out of deference to red-tapism. Promotions cannot always come from within the ranks, and neither can the best man always be selected from the waiting list of applicants on file with the bureau of employment.

Editorial Comments

Power plants should be designed for the special duties they are to perform and the wide field covered by isolated plants permits and requires a great variety of arrangements if best results are to be secured. In the leading article for this issue we publish a description of a plant for a packing house. This is one industry where the central station has not successfully met the competition of the isolated plant and a study of the services performed in the plant described and the equipment employed should reveal to the reader the prevailing features of a successful isolated plant.

Among the newer types of steam engines we find the poppet-valve and the uniflow, both of which have been developed abroad and are coming to us well past the experimental state, so far as the mechanical design and successful operation are concerned; but to meet with success here surrounding conditions must be changed from our ordinary practice. Some of these are considered on another page of this issue.

For successful operation, turbines require high vacuum; it is necessary therefore that the condenser perform its functions correctly. In the article by Mr. Cozzens are given some interesting schemes for studying condenser performance which will be of aid to those in charge of this auxiliary.

Under the title of Oil Fuel is published the first of a series of 4 articles abstracted from a paper presented at the International Engineering Congress. This fuel is available to many plants in this country and a study of its qualities may put you in position to save considerable money on fuel.

The second and last article of the series on Rigid Conduit Wiring Hints by Mr. Croft points out the functions of various fittings and where they should and should not be used; grounding is also considered. The information given is of aid to the man on the job.

Seldom is it possible to secure cost data such as given in the article on Wiring Costs by H. E. Weightman and the information given there should be preserved for ready reference.

By special arrangements with Mr. Broido, who was an eminent engineer in Germany and has but recently come to this country, we are permitted to publish in this issue the first of a series of articles on his Experiences with Power Plants in Germany. He brings a working knowledge of things abroad and will give information which should enable us to increase our power plant efficiencies.

Reginald Trautschold presents the third and last article of his series on Gas Producer Control; in this he deals with the use of exhaust gas for securing proper combustion, a method which is both economical and sensitive.

Considering the Diesel engine as a competitor of the central station, a committee of the N. E. L. A. presented a report at the recent convention which has been abstracted for our readers. Some valuable data are given which should not be overlooked.

Among the letters in this issue we particularly call your attention to the homemade oil filter, firing record and blowing boiler tubes with air which represent respectively invention, industrial art and applied sciences as we find them in the power plant. Don't miss the other letters either, for they may help you out of a difficulty.

Have you trouble with your gas collector, elevator safety stop or storage batteries? The helping hand has been extended to others in these directions and we pass it on to you. There is also a list of practical questions answered in this department which may help to refresh your mind if you have solved similar problems before.

Among power plant apparatus recently developed we describe an electric lamp for blueprinting, an oil burner valve, a single-phase motor and a refillable fuse shell, all of which are of value to the engineer.

For your ready reference you will find charts which apply to fuel oil, a table and chart for determining the contents of tanks and data on economy in the boiler room. Don't fail to preserve them all.

THE FIRST HALF of 1916 has been a busy period for the Portland cement industry in most parts of the United States, according to the U. S. Geological Survey. Labor troubles have caused the temporary shutting down of a few plants in Illinois, and the business ordinarily taken care of by these plants has gone to others in the Central States, but none have been reported as having voluntarily closed in 1916. The opening of a new cement plant nowadays, when the country is so well dotted with plants, is an event of importance, and the fact that two new plants have begun operations is of considerable interest. Both of them are in the Middle West, one at its extreme north, at New Duluth, Minn., the other at its extreme south, at Houston, Tex. The location of both was influenced more largely by commercial considerations than by the proximity of raw materials. The plant at New Duluth, a mill of the Universal Portland Cement Co., utilizes limestone brought by boat from the shore of Lake Huron, near Alpena, Mich., and slag from the blast furnaces of the Minnesota Steel Co. at New Duluth. The plant at Houston is mill No. 2 of the Texas Portland Cement Co. It manufactures cement from oyster shells dredged from a reef in Galveston Bay and clay from Harrisburg, Tex. This plant is on tidewater, and efforts will be made to establish for it an export trade with South America.

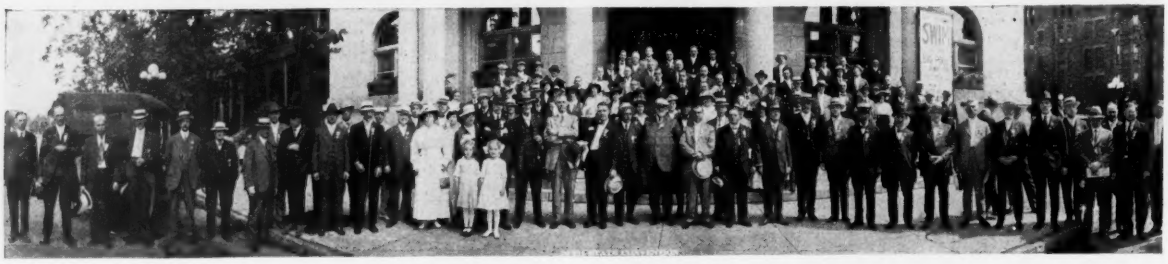
Among the Buckeyes

OHIO STATE ASSOCIATION OF THE N. A. S. E. HOLDS TWENTIETH ANNUAL CONVENTION IN DAYTON, JUNE 15-17

TO all engineers arriving at the Algonquin Hotel, Thursday morning, several hands of welcome were extended, for on the preceding evening there had been an informal reception which had been arranged by the local committee and attended by a number of out-of-town guests. So with not only the printed welcome sign but the extended hands of friends, registration was made easy.

Equipped with an official badge and a program, the engineer was given every consideration. The program was a 44-page, leatheret-bound book, containing, besides the regular events planned for the convention, a short historic sketch of the State Association, pictures of the officers, several instructive technical articles, useful information and a host of advertisements. Everybody took his copy home with him and there was none left to be chucked into the waste basket.

At 9 o'clock, C. Robinett, chairman of the local committee, called the convention to order in the hall on the roof of the hotel where all meetings were held, and after prayer by Rev. Cook, City Attorney J. D. Clark extended a welcome to the engineers which was responded to by F. L. Ray, past national president. Interesting addresses relating to the engineer, his work and his organization were then given by John A. Kerley, national vice-president, Thos. F. Synnett, Judson Pratt and others prominent in N. A. S. E. affairs.



DELEGATES AND FRIENDS AT THE OHIO CONVENTION

Convening again at 2 o'clock, the chair was assumed by State President W. F. Brubaker, who opened the convention formally and appointed committees and instructed them in the duties they were expected to perform.

Formal opening of the Exhibit Hall took place at 7 o'clock, when Edwin G. Jaques, past national president, gave the address, calling the attention of engineers to the benefits they could derive from an examination of the articles on exhibit and a discussion of their merits by the representatives in charge.

Friday morning the convention was called to order early and the various committees gave their reports. The credentials committee reported 41 delegates and 15 alternates present, all of whom were given the right of vote in the business proceedings.

There was considerable discussion as to the best methods of boosting membership. In the past, it seems that this work has been done largely by individuals at their own expense, but this was not considered just, and an effort will be made to have more of this work done by the state deputy, whose expenses are paid by the national association.

The committee on legislation recommended that efforts be made to secure a reduction in fee for state license renewal from $2 to $1. It was stated that the license law department of the state is more than self sustaining, and it is estimated that this reduced charge, which comes annually, will support the department under the conditions that now exist.

An effort was made to secure the passage of a resolution opposing the appointment of a man, evidently an engineer but not a member of any of the engineering associations, to the office of examiner of engineers. This resolution was laid on the table, thus keeping the association out of political entanglements.

The invitation of the delegation from Columbus to enjoy the hospitality of that city during the 1917 convention was accepted and election of officers resulted as follows: C. W. Smith of Columbus, president; L. A. Kroner of Cleveland, vice-president; D. E. Kennedy of Cincinnati, secretary; T. S. Garrett of Dayton, treasurer; F. B. Seidel of Tiffin, conductor; W. E. Yoxtheimer of Findlay, door-keeper; F. P. Brownstead of Columbus, recommended for state deputy; W. F. Brubaker of Toledo is past-president.

The business sessions of the convention closed Saturday morning with the installation of officers, after which a short paper was read by Judson Pratt on refuse burning.

Entertainment features of the occasion were: A lecture entitled From Ore to Finished National Pipe, by a representative of the National Tube Co., illustrated with motion pictures. Thursday afternoon rain prevented the ball game which was scheduled for that time, so those in attendance accepted the invitation of the Dayton Brewery Co., and were entertained with music and served refreshments at this company's private park. Saturday evening musical entertainment, dancing and refreshments on the Algonquin Roof Garden were indulged in by those who remained for the finals. Several small parties were formed at different times who visited factories and other places of interest about the

city, and the ladies in attendance were entertained with theater parties and automobile rides during their entire stay.

EXHIBITS

IN THE American dining room of the Algonquin Hotel, booths were arranged for the convenience of exhibitors who displayed power plant apparatus and accessories and explained, to those interested, the operation and advantages of their products. The hall was attractively decorated and during afternoons and evenings an orchestra furnished music for entertainment. Companies represented in the hall were:

American Engineering Co., Philadelphia, Pa.; American Steam Gauge & Valve Mfg. Co., Boston, Mass.; American Steam Pump Co., Battle Creek, Mich.; V. D. Anderson Co., Cleveland, O.; The Anchor Packing Co., Philadelphia, Pa.; Arrow Boiler Compound Co., St. Louis, Mo.; Atlas Rubber & Belting Co., Dayton, O.; The Babcock & Wilcox Co., Barberton, O.; Betson Plastic Fire Brick Co., Rome, N. Y.; Bowers Rubber Works, San Francisco, Cal.; James A. Brady Foundry Co., Chicago, Ill.; L. I. Breakey, Marshall, Mich.; Buckeye Chemical Co., Detroit, Mich.; Cleveland Alloys Co., Cleveland, O.; Cling-Surface Co., Buffalo, N. Y.; Crandall Packing Co., Cleveland, O.; Dayton Supply Co., Dayton, O.; Dearborn Chemical Co., Chicago, Ill.; Myron H. Detrick Co., Chicago, Ill.; Edward Valve & Mfg. Co., Chicago, Ill.; Excelsior Boiler Compound Co., Dayton, O.; Garlock Packing Co., Cleveland, O.; Graves & Marshall Co., Dayton, O.; Wm. Hall Electric Co., Dayton, O.; The Hawk-Eye Compound Co., Chicago, Ill.; Hills-McCanna Co., Chicago, Ill.; Home Rubber Co., Trenton, N. J.; Jackson & W. Va. Fuel Co., Dayton, O.; Jenkins Bros., Chicago, Ill.; Johns-Manville Co., Cleveland, O.; Chas. M. Kelso Co., Dayton, O.; Keystone Lubricating Co., Philadelphia, Pa.; Kitts Steam Specialty Co., Oswego, N. Y.; John L. Kneisley, Dayton, O.; Kramer Bros. Foundry Co., Dayton, O.; Lagonda Mfg. Co., Springfield, O.; Lake Erie Mfg. Co., Cleveland, O.; M. D. Larkin Supply Co., Dayton, O.; Lumen Bearing Co., Buffalo, N. Y.; The Lunkenheimer Co., Cincinnati, O.; Jas. McMillan & Co., Chicago, Ill.; Manning, Maxwell & Moore, Inc., New York, N. Y.; The Model Stoker Co., Dayton, O.; National Boiler Protector Co., Dayton, O.; National Engineer, Chicago, Ill.; Patterson Tool & Supply Co., Dayton, O.; Peerless Rubber Mfg. Co., New York, N. Y.; The Perolin Co. of America, Chicago, Ill.; Wm. Powell Co., Cincinnati, O.; Power, New York, N. Y.; Practical Engineer, Chicago, Ill.; Precision Instrument Co., Detroit, Mich.; Richardson Scale Co., Chicago, Ill.; James Saunders Machine Co., Dayton, O.; Chas. A. Schieren & Co., New York, N. Y.; Scully Steel & Iron Co., Columbus, O.; G. L. Simonds & Co., Chicago, Ill.; Skinner Engine Co., Erie, Pa.; Southern Engineer, Atlanta, Ga.; The Standard Oil Co., Dayton, O.; Thos. F. Synnett & Son, Dayton, O.; The Valvoline Oil Co., Cincinnati, O.; Warren Webster & Co., Camden, N. J.

In Connecticut

STATE ENGINEERS' MEETING, JUNE 23 AND 24

LONG, sunny days and the beautiful city of New Haven gave every possible advantage for a profitable and pleasant meeting, and delegates made the most of it. The convention was purely for business, and sight seeing and frolic were cut out until after the convention was adjourned. Then a rousing banquet was held at the unique playground of the city, Savin Rock.

GROUP OF ENGINEERS AT NEW HAVEN

Meetings and exhibit were held in Music Hall, which gave every convenience and ample space; and hotel headquarters were established at the Taft, where there was much fraternizing of delegates, guests and supply men during the periods between more serious matters.

First on the program was the opening of the exhibit by a representative of Mayor Rice, who gave cordial welcome and wishes for a pleasant visit to New Haven, the welcome being acknowledged by National President Walter Damon. The rest of Friday morning was spent in the exhibit hall, the meeting for organization and appointment of committees being called at 1:30, and carrying out the usual preliminary routine. Afternoon was also devoted to the exhibits and in the evening a short program was given by the group of entertainers known as the "Bunch" and made up of talented representatives from New York manufacturers and supply houses. Addresses were also made by President Damon and Past President Reynolds.

At the meeting of Saturday there were reported present 25 delegates and 14 officers and past officers, making the total acting body of 39. The regular reports of officers and committees were received, showing that the edu-

cational contest among subordinate associations had not received as much attention as might well have been given it, but the finances are in very satisfactory condition. There are at present some 560 members in Connecticut with most of the associations in lively condition; but the average attendance at meetings has not been as large as could be wished, averaging something like 20 per cent of the members.

After discussion of the advisability of combining the meetings of the Connecticut Engineers with that of the engineers of other New England states, a committee was appointed to confer with representatives of the Connecticut Supply Men's Association to report a plan for action, and the result was a resolution to invite the New England States Association, which includes all other states except Connecticut, to meet with the Connecticut Association in 1917 at Bridgeport, the meeting for 1918 going to some city in one of the other states, to be chosen later. It was also decided to send a committee to Fall River to present this invitation to the New England States Convention and to act with a committee from the Supply Men to secure the co-operation of the New England Commercial Engineers Association.

Election of officers resulted in the choice of Elmer E. Thomas, of New Haven, for president; W. H. Brown, of Waterbury, for vice-president; Oscar A. Thomas, of Bristol, for secretary-treasurer; A. A. Anderson, of Bridgeport, for conductor; R. W. Heiser, of Danbury, for door-keeper, and James McGee, of Hartford, for trustee. F. M. Hastings, of Meriden, was recommended for re-appointment by the national president as state deputy.

Exhibits

In the hall, which was decorated with flags and a border of green and white bunting, were displays by the following firms: Albany Lubricating Co., New York; American Steam Gauge and Valve Mfg. Co., Boston; V. D. Anderson Co., Cleveland; Atwood and Morrill, Salem, Mass.; Babcock and Wilcox Mfg. Co., New York; Bigelow Boiler Co., New Haven; Belmont Packing Co., Philadelphia; Bowers Rubber Works, San Francisco; Crandall Packing Co., Palmyra, N. Y.; Crane Valve Co., Bridgeport, Conn.; M. T. Davidson Co., New York; Dearborn Chemical Co., Chicago; Eagle Oil and Supply Co., Boston, including Perolin Co. boiler treatment; Eureka Packing Co., New York; J. B. Ford, Wyandotte, Mich.; Garlock Packing Co., Palmyra, N. Y.; Golden Anderson Valve Specialty Co., Pittsburgh; F. W. Gordon, Bridgeport, Conn., including Coppus Engineering Co.; Hartford Mill Supply Co., Hartford, Conn., including Jefferson Unions; Hill Publishing Co., New York; Home Rubber Co., Trenton, N. J.; Huber Hand Stoker Co., New York; Jenkins Bros., New York; H. W. Johns-Manville Co., New York; Robert A. Keasbey Co., New York; Keystone Lubricating Co., Philadelphia; Lunkenheimer Co., Cincinnati; Manning, Maxwell and Moore, covering Asheroft Mfg. Co., Consolidated Safety Valve Co., Hancock Inspirator Co., Hayden and Derby Mfg. Co., New York; McLeod and Henry Co., Troy, N. Y.; McClave Hand Brooks Co., Scranton, Pa.; C. S. Mersick, New Haven; National Engineer, Chicago; National Pipe Bending Co., New Haven; Nightingale and Childs Co., Boston, including the Swartwout specialties; Open Coil Heater Co., Indianapolis; Perfection Grate and Supply Co., Springfield, Mass.; Philadelphia Grease Co., Philadelphia; Peerless Rubber Mfg. Co., New York; Pratt & Cady, Hartford, Conn.; Practical Engineer, Chicago; Pyramid Grate Bar Co., New York; Wm. Powell Co., Cincinnati; Quaker City Rubber Co., Philadelphia; Spencer Turbine Cleaner Co., Hartford, Conn.; Geo. R. Starrs, Paterson, N. J., including Greene, Tweed & Co., Terry Steam Turbine Co., Hartford; Whitlock Coil Pipe Co., Hartford.

At the meeting of the Supply Men, the question of joint meetings with the New England Commercial Engineers was referred to a committee with the result stated previously, and it was voted to send a Supply Men's committee to Fall River to take up the matter, the organization and funds of the Connecticut Association to be maintained until it was certain that the joint plan is a success. Officers were re-elected as follows: Honorary president, J. H. Foote, of McLeod & Henry; acting president, Thomas Platt, of Dearborn Chemical Co.; vice-president, John Lutz, of Hartford; secretary-treasurer, H. M. Gynne, of C. S. Mersick Co.; executive committee, F. Bulkley, Jr., of Garlock Packing Co., John Harrington, of Wynne Oil Co., E. S. Burnham, of McClave & Brooks Co., W. M. Muller, of Peerless Rubber Mfg. Co., and Fred Upson.

Kokomo is Host to Indiana Engineers

Hoosier Association Convenes at the "Hum" Town of "The Man From Home"

RAINY weather, delayed freight service, and a few other factors beyond the control of Kokomo did not dampen the enthusiasm displayed at the opening session of the Twelfth Annual Indiana Convention of the N. A. S. E., which was called to order Wednesday, June 21, at 10 a. m. by Elza A. Stone.

After the invocation by Rev. W. B. Freeland, an address of welcome was offered for Kokomo by Joseph Herron, and a response was made by F. W. Raven, National Secretary of the Association. W. H. Arnett, of the Kokomo Chamber of Commerce, extended the full courtesies of the city to the delegates and visitors, and expressed the wish that the convention would be recorded as a complete success. The State President, Albert Franke, was then introduced and delivered a brief address. Charles Cullen, speaking for the Central States Exhibitors' Association, then declared the exhibits opened, and the convention was officially launched.

During the first business session held that afternoon, the delegates heard the reports of the State President and State Secretary, and communications were read from the state organizations of Wisconsin, Kentucky and Illinois. Whether or not Indiana should consolidate with Michigan and Kentucky in holding one convention for these 3 states, was one of the problems offered for discussion. It was decided to retain the present system for a separate convention.

Wednesday evening a reception and smoker given by the Exhibitors' Association drew a large Kokomo gathering, which keenly enjoyed the entertaining pro-

gram presented by various members of the C. S. E. A. Charles Cullen was in good form, and easily achieved the honors of a "star" attraction.

At 10 a. m. Thursday, June 22, the second session was called to order and devoted to routine business. It was reported that 15 delegates were in attendance and that guests and exhibitors brought the total registration to 78. After lunch an automobile inspection tour was made to the important Kokomo industries. Visits were made at the Kokomo Steel & Wire Co., the Haynes Automobile Plant, the Kokomo Rubber Co., and the power house of the Indiana Railways & Light Co.

In the evening a banquet was held with F. W. Raven as toastmaster. Speakers were unanimous in their praise of the hospitality displayed by the Kokomo Association. At the close of the program, the guests adjourned to a movie show, where a General Electric film showing some of the operating features of the Panama Canal was a special attraction.

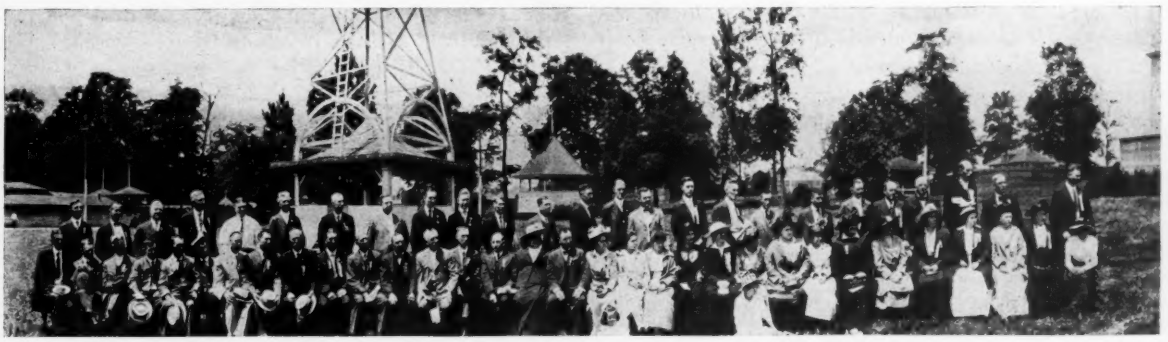
At the final session, held Friday, June 23, at 10 a. m., the following officers were elected: President, John Lantz of Richmond; vice-president, Elza Stone, Kokomo; Secretary, I. A. Baldus, Indianapolis; Treasurer, H. E. Smith, South Bend; Conductor, George Seng, Terre Haute; Doorkeeper, J. C. Patsmith, Indianapolis.

Evansville or Anderson will be the location of the next convention. Evansville is a candidate to entertain the national convention in 1917. If the national convention is awarded to Evansville, the state convention will be held there also, but should Evansville not be selected for the national convention, the state association will convene at Anderson.

A thrilling ball game between the engineers and exhibitors was the closing event on the program. No score keeper could possibly have recorded the seventy-odd runs made, but F. L. Clifford of the local organization gallantly announced that the Exhibitors had won by a score of 7 to 6.

Exhibits

Although delays in shipment interferred somewhat with the completeness of several exhibits, the displays attracted considerable attention. Following is a list of the firms represented: V. D. Anderson Co., Cleveland, O.; Cling-Surface Co., Buffalo, N. Y.; Crandall Packing Co., Palmyra, N. Y.; Dearborn Chemical Co., Chicago; Edward Valve & Mfg. Co., Chicago; M. H. Detrick Co., Chicago; Garlock Packing Co., Palmyra, N. Y.; Hawk-Eye Compound Co., Chicago; Indianapolis Supply Co., Indianapolis; Jenkins Bros., New York City; H. W. Johns-Manville Co., New York City; Keystone Lubricating Co., Philadelphia; Kokomo Supply Co., Kokomo, Ind.; Lunkenheimer Co., Cincinnati; Magic Boiler Compound Co., Chicago; National Engineer, Chicago; Peerless Rubber Co., New York City; Wm. Powell Co., Cincinnati; Power, New York City; Practical Engineer, Chicago; G. L. Simonds Co., Chicago; Southern Engineer, Atlanta, Ga.



DELEGATES, EXHIBITORS AND GUESTS ATTENDING INDIANA CONVENTION OF N. A. S. E.

The Innocent Little Fish Worm

THAT engineering work in different phases occasionally has its lighter and humorous side is shown by the following case which was recently brought up in an Ohio court:

A woman resident of Bucyrus experienced great concern because an ambitious little fish worm selected the water meter of her house as a desirable abiding place; in forcing its way into this cheerful quarter, the little worm caused the valve of the meter to leak, resulting in a waste of water and consequent registering of a greater amount than actually used.

Bringing action for the overcharge made by the water company, it was set forth in court that water to the value of $8.25 was registered during this particular month, while in reality only an amount to the total of $2.50 was actually consumed. The court was asked to direct the water company to accept this latter sum in full payment, as well as to enjoin the company from shutting off the water on account of the refusal to pay the gross amount, an overcharge caused, the woman maintained, by the little fish worm monkeying with her water meter.

In Commerce Reports, published by the Bureau of Foreign and Domestic Commerce, request is mentioned from a man in Honduras who wishes to get in touch with American manufacturers of engines; from a consulting engineer in Sweden who wishes catalogs and price-lists of American contractors' equipment for digging, lifting and conveying; of the opening for proposals, through the Supervising Architect, with the Treasury Department for the United States post office building at Putnam, Conn., and for the furnishing of reinforced concrete and paving at the Milk River irrigation project at Malta, Mont. Full details may be had from the Department of Commerce, Washington, D. C.

American Order of Steam Engineers

THIRTIETH ANNUAL CONVENTION IN NEW YORK CITY

FROM the morning of June 26 until noon of the 30th, the chief point of interest for members of the American Order was in the Hotel McAlpin, where the meetings were held in the Green Room on the mezzanine floor, and the exhibits were displayed in the beautiful Grill Room in the basement. This hall with arched roof and tiled decorative scenes was splendidly adapted for the purpose, and was handsomely fitted out by the superintending engineer of Hotel McAlpin, Joseph Carney, so that the minimum of trouble was found in installing an attractive and satisfactory exhibit of power plant apparatus and specialties. Owing to the business conditions, the exhibit was not as large as some that had been held in former years, but the quality was fully up to the high standard previously maintained.

The program of the convention included a wise mixture of business and relaxation, covering 2 business sessions on Monday, and the official opening in the evening, which was enlivened by piano solos, by an address of welcome from Geo. Richardson, past supreme chief engineer, by addresses from J. W. Pairent, supreme chief of the American Order, D. B. Heilman, past supreme chief and Chas. A. Wilhoft, president of the American Supply Men's Association.

GROUP OF DELEGATES OF AMERICAN ORDER

An incident of the evening which brought home to all in attendance the unfortunate situation now existing with regard to Mexican affairs, was the presence of Wm. G. Le Compte, past president of the Supply Men's Association, who had been expected to preside at the meeting. As he is Quarter Master Sergeant of the 7th Regiment, New York National Guard, he was obliged to be with his regiment and could only escape for a short time, but showed his devotion to the good of the engineers' convention by spending a considerable part of that time at the meeting.

Mr. Pairent, in his address, emphasized the principles of the American Order, which are education, not compulsion; to secure better working conditions for the engineer, license laws to improve the service given to the public, and better wages and working conditions, commensurate with the importance of the work of the engineer. All this, however, is to be accomplished by proving, through education of engineer and employer, that these are wise lines of advancement.

Mr. Heilman emphasized the need of study of technical magazines, and of becoming familiar with the material advertised in them. It is necessary for the engineer to be fully aware of the new helps available to make his work easier and the operation of his plant more economical, and the technical journal, through its editorial and advertising pages, is the engineer's best friend in accomplishing this result.

Mr. Wilhoft told of the objects of the Supply Men's Association, and the advantage of the exhibit at a convention in enabling the engineer to see the operation and construction of new types of machinery, and the advantage to the manufacturer in being able to show both sides of the machine, even in operation, in a way much more convincing than can be done by an agent visiting the engine room.

Mr. Le Compte spoke of the necessity of the engineer being an expert in many lines, and the possibility of learning something in each line from the experts sent by the manufacturers who have charge of the exhibits. He gave many interesting incidents of his work as Quarter Master, and outlined briefly the history of the Supply Men's Association, then declared the convention and the exhibit open for the inspection of the public.

Tuesday morning was taken up partly with a business session and partly with an address by Halbert P. Hill on the electrical treatment of gases and vapors to precipitate dust and moisture. The process is one by which the electrified molecules are driven to the sides of the pipes through which the material is passing and drop to the bottom. The system is in use in many places for removing dust and particles of moisture, but is somewhat expensive and has so far been found advantageous only where the product recovered is of considerable value. There is no difficulty, however, in removing the moisture from the steam or the soot from smoke by this method. The tubes used are 12 in. in diameter by 15 ft. long, of tile or sheet metal, and the gases may be treated hot. As the process is dry, it avoids, also, the difficulties encountered with a washing system.

Tuesday afternoon was devoted to a trip in automobiles to Coney Island, a shore dinner, and the inspection of the amusements to be found in Luna Park. The weather was perfect, arrangements complete, and the affair greatly enjoyed by all delegates and visitors. The evening was given to an inspection of the exhibits in the Grill Room, where the discussion among engineers and supply men was carried on until a late hour.

Mornings of Wednesday, Thursday and Friday were devoted to business sessions, and a session was also held in the afternoon on Wednesday. Luncheon was served Wednesday noon to all visitors at the new building of the Hill Publishing Co., and after the luncheon, the visitors were shown through the office and printing plant and the power plant of the building. The evening of Wednesday was marked by an entertainment given by the New York "bunch," and Thursday afternoon was made pleasant by a sightseeing trip about the city in automobiles furnished through the courtesy of Jenkins Bros.

Meetings of the supply men were held every day for the purpose of taking up various matters that came up during the week, and on Thursday, election of officers was held, resulting as follows: President, Harte B. Hill of the Lagonda Mfg. Co.; vice-president, A. E. Smith of Jenkins Bros.; secretary, Porter G. Jones of Dearborn Chemical Co.; treasurer, John W. Armour of Hill Publishing Co.; executive committee, C. A. Wilhoft, New York Belting & Packing Co.; H. A. Smith, Philadelphia Grease Mfg. Co.; S. J. McCullam, R. & J. Dick, Ltd.; Harry Souders of John R. Livezey; Andrew Lauterbach, Lunkenheimer Co.; L. R. Duffield of the Philadelphia Bourse; Herbert Selfe of the Peerless Rubber Mfg. Co.; Warren France of France Packing Co.; E. P. Watrous of the Garlock Packing Co.; J. E. Montgomery, Warren Webster & Co.; Morris E. Conn of the Engineering Supply Co.; F. T. Tuthill, McLeod & Henry Co.

After installation of officers, President Hill told some of his plans for the coming year, including regular dinner meetings in Philadelphia every month, at which addresses will be given on salesmanship by sales managers, and on the faults of salesmen by engineers. The thought is to make the Association a co-operative selling organization, active throughout the year instead of only at the time of the exhibits. President Hill announced also the appointment of Wm. Lindenfelser, Jr., of the Texas Co., as director of exhibits for the next convention, and a committee of three, called a General Utility Committee, J. W. Armour in charge of entertainment, Frank Martin in charge of reception and publicity, and Chas. Frick in charge of education.

Election of officers by the American Order on Thursday resulted in the following choice: Supreme Chief Engineer, J. Wm. Pairent of Philadelphia; Supreme First Assistant, John McKewen of Baltimore; Supreme Recording Engineer, John Martin of Kensington, Pa.; Supreme Corresponding Engineer, F. J. Armbruster, Manayunk, Pa.; Supreme Treasurer, W. H. Tyson, Philadelphia; Supreme Senior Master Mechanic, W. R. Smith, Coplay, Pa.; Supreme Junior Master Mechanic, C. A. Caldwell, Rockland, Mass.; Supreme Chaplin, Hiram Trout, Reading, Pa.; Supreme Outside Sentinel, Philip A. Kirkwood of Baltimore; Supreme Inside Sentinel, J. J. Morris of Atlantic City; Trustee, D. B. Heilman, Reading. Philadelphia was chosen as the place for the convention and exhibit for 1917.

On Friday morning, the closing session of the two organizations was held jointly. The officers of each association were presented to the members of the other organization, and in addition, the members of the co-operative committee, consisting of Messrs. C. P. Williams, Geo. R. Richardson and Franklin Moore of the American Order, and Charles Frick, J. W. Armour and Frank Martin of the supply men, were announced. Resolutions of thanks were passed to the Hill Publishing Co., to Jenkins Bros. and the Hotel McAlpin for their courtesies during the week.

F. L. Jahn, in behalf of the Supply Men's Association, presented to President Pairent a token of the esteem of the association, consisting of $60 in gold to be invested by Mr. and Mrs. Pairent in such article as they might most desire. J. W. Armour, in behalf of the Supply Men, presented to retiring President Wilhoft a watch, making a witty speech, in which he alternately praised and roasted the recipient of his favor. It was all taken in good part, however, and Mr. Wilhoft, in replying, urged harmony and co-operation between the associations, expressed his gratitude for the honor done him in selecting him as president, and offered his help in every possible way to make future conventions a success.

President Pairent in virtue of his re-election then closed the meetings of the convention, expressing his regret at the ending of a pleasant week, and his satisfaction over friendships formed and renewed at the yearly meetings.

The attendance of delegates and visiting engineers was 130.

The firms exhibiting in the Grill Room were as follows: American Manufacturing & Sales Co., York, Pa.; American Steam Gauge & Valve Mfg. Co., Boston, Mass.; Anchor Packing Co., Philadelphia, Pa.; V. D. Anderson Co., Cleveland, O.; E. B. Badger & Sons Co., Boston, Mass.; Budd Grate & Foundry Co., Philadelphia; Bourse Machinery Exhibit, Philadelphia; Cyrus Borgner, Philadelphia; R. & G. Dick, Ltd., New York City; Jos. Dixon Crucible Co., Jersey City, N. J.; Dearborn Chemical Co., Chicago; G. Frank Duemler, Philadelphia; Engineering Supply Co., Philadelphia; Foxboro Co., Inc., Foxboro, Mass.; Frick Grate Bar Co., Philadelphia; France Packing Co., Tacony, Pa.; Garlock Packing Co., Palmyra, N. Y.; Griscom-Russell Co., New York City; Golden Anderson Valve Specialty Co., Pittsburgh; International Correspondence Schools, Scranton, Pa.; Jenkins Bros., New York City; H. W. Johns-Manville Co., New York City; Keystone Lubricating Co., Philadelphia; Lunkenheimer Co., Cincinnati, O.; Lagonda Mfg. Co., Springfield, O.; John R. Livezey, Philadelphia; McLeod & Henry Co., Troy, N. Y.; McLaughlin & Donovan, New York City; W. B. McVicker Co., New York City; Mason Regulator Co., Boston; New York Belting & Packing Co., New York City; Paige & Jones Chemical Co., New York City; Peerless Rubber Mfg. Co., New York City; Philadelphia Grease Mfg. Co., Philadelphia; Popular Engineer, Philadelphia; Practical Engineer, Chicago; Power, New York City; Pyramid Grate Bar Co., New York City; Quaker City Rubber Co., Philadelphia; Wm. C. Robinson & Son Co., Baltimore; John Simmons Co., New York City; Texas Co., New York City; Vanda Co., New York City; Watson & McDaniel Co., Philadelphia; Warren Webster & Co., Camden, N. J.

The Exhibit Committee for the 1917 convention was appointed by the supply men, as follows: Geo. L. Lyons of Pyramid Grate Bar Co.; J. Maurice Willets, Jos.

Dixon Crucible Co.; Henry Bennet, Paige & Jones Chemical Co.; M. J. Fleming, Anchor Packing Co.; Fred L. Jahn, Watson & McDaniel Co.; Henry Moseley, Budd Grate & Foundry Co.; Geo. H. Dickel, Cyrus Borgner; W. Wagner, American Steam Gauge & Valve Mfg. Co.; W. R. North, V. D. Anderson Co.; P. Leighton, American Mfg. & Sales Co.; D. J. Deaver, E. B. Badger & Sons Co.; G. F. Duemler; Willis C. Brown, Foxboro Co.; Chas. Clees, Jr., Golden Anderson Valve Specialty Co.; E. H. Harris, Griscom-Russell Co.; J. D. Jones, International Correspondence Schools; Geo. D. Lewis, H. W. Johns-Manville Co.; Thos. Reed, Keystone Lubricating Co.; R. J. Donovan, McLaughlin & Donovan; A. T. Canden, W. B. McVicker Co.; F. Morrison, Mason Regulator Co.; Leo. Meyer, Quaker City Rubber Co.; E. G. Hagerdorn, Vanda Co.; Theo. Bailey, Wm. C. Robinson & Son Co.; A. L. Rice, Practical Engineer.

Williamsport, Pa., Convention of Engineers

ON THE 16th of June there foregathered at Williamsport, representatives of the engineers of Pennsylvania to hold the state convention, elect new state officers and take up such matters as might come before them. No exhibit was held in connection with the convention, as it was not thought that the attendance would be sufficient to warrant the expense to exhibitors, but many firms contributed toward the entertainment of the delegates and visiting engineers.

Routine business was transacted, including receiving the reports of committees and discussion of the work of the past and for the coming years. Addresses were made by National President Walter H. Damon, and National Treasurer Samuel B. Forse. The following new officers were elected: President, L. S. Evans, Pittsburgh; vice-president, Ernest Uff, Chester; secretary, R. B. Ambrose, Pittsburgh; treasurer, Ralph Davis, Woodlawn; conductor, Charles Kehrer, Williamsport; doorkeeper, M. P. Connelly, Sharon. The convention for 1917 will be at Sharon, Pa.

The firms contributing to the expenses of the convention were as follows: American Huhn Metallic Packing Co.; American Steam Gauge & Valve Mfg. Co.; Atlantic Refining Co.; Dearborn Chemical Co.; R. & J. Dick, Limited; Geo. Frank Duemler; Eagle Lubricating Oil Co.; Garlock Packing Co.; Jenkins Bros.; Robt. Ross Jones; Hawk-Eye Compound Co.; Homestead Valve Mfg. Co.; E. Keeler Co.; The Lunkenheimer Co.; National Engineer; Peerless Rubber Mfg. Co.; Power; Practical Engineer; Quaker City Rubber Co.; Wm. C. Robinson & Son Co.; Geo. R. Starrs; Watson & McDaniel Co.; The Wickes Boiler Co.

The photograph of delegates herewith was furnished by the courtesy of E. Keeler Co.

GROUP OF DELEGATES AT THE PENNSYLVANIA STATE CONVENTION

DR. W. F. M. GOSS, Dean of the College of Engineering of the University of Illinois, has, upon the nomination of the American Society of Mechanical Engineers, been appointed by Hon. Josephus Daniels, Secretary of the Navy, as a Member of the Board of Directors of the Organization for Industrial Preparedness for the State of Illinois, and as Associate Member of the Naval Consulting Board.

The Illinois State Board of Directors consists of William Hoskins, Member of the American Chemical Society; Captain Robert W. Hunt, member of the American Society of Civil Engineers; Peter Junkersfeld, member of the American Institute of Electrical Engineers; F. K. Copeland, member of the American Institute of Mining Engineers, and Dean W. F. M. Goss, member of the American Society of Mechanical Engineers.

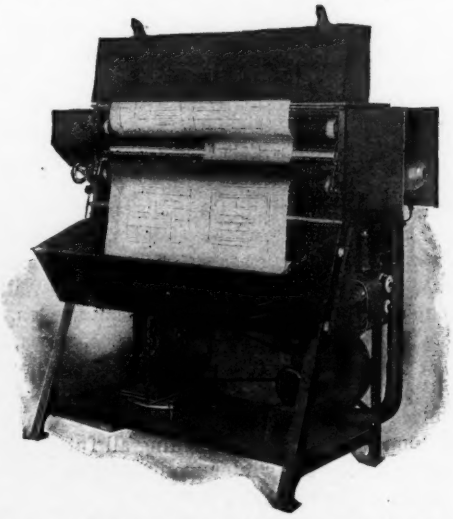
At the first meeting of the Board F. K. Copeland was elected Chairman and Secretary, and William Hoskins was elected Treasurer. It was unanimously agreed that a fund of $25,000 should be raised to cover the expenses incident to the work of the Board.

Power Apparatus in Shop and Market

New Ideas In Making, Buying and Selling

Cooper Hewitt Lamps for Electric Blueprinting

THE design of the Everett-McAdam blueprint machine, made by the Revolute Machine Company, is based upon a revolving glass cylinder, the light being within the cylinder and the rays striking practically perpendicular to the surface of the blueprint paper wrapped around the cylinder. The paper is laid over the revolving glass cylinder, where it remains during ¾ of a revolution, after which it leaves the cylinder and is caught in a suitable receptacle. The tracings



THE EVERETT-McADAM BLUEPRINT MACHINE

are fed in between the paper and the cylinder so that the light strikes through the glass and the tracing on to the blueprint paper.

Continuous rolls of any length may be fed through the machine with either long tracings or those of smaller sizes, so that an extra standard roll of 50 yd. may be printed in one piece.

Special high-power lamps, made for this particular service by the Cooper Hewitt Electric Co., of Hoboken, N. J., allow the machine to print at a high speed on comparatively small current consumption. This speed efficiency is due partly to the design of the machine having the lights within the cylinder, and partly to the quality of the light from the mercury lamps, which is well adapted to blueprint work.

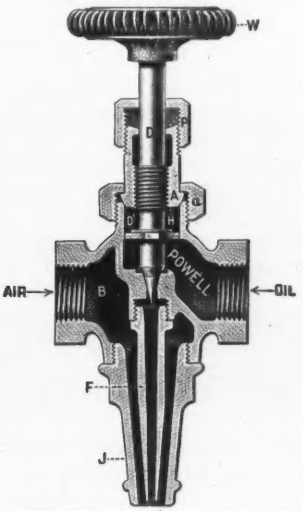
Arc lamps may also be used on this sort of a machine. In the case of this type of lamp, which must be hung outside the cylinder, the light passes through the cylinder to the paper on the opposite side from the lamps, and the printing is done during half a revolution. Where mercury lamps are used, placed inside the cylinder, the light passes through one thickness of glass, and the printing is done during ¾ of a revolution. The mercury lamps are automatic and start by the turn of a switch, and, in contrast to arc lamps, require no attention whatever during their life, guaranteed to be 1200 hr.

The machine, which is electrically driven, is equipped with a variable speed gear which allows it to be run at a speed necessary to suit the requirements of different kinds of paper and different tracings or negatives to be printed.

Oil Burner Valve

COMPARATIVELY small in size, but large in importance is the burner valve used in connection with the heating unit of an oil-burning appliance, as the economy of the installation may rest upon the efficiency of the burner valve.

In developing the Powell oil burner valve, a number of special tests were made for proportioning the oil tubes and air nozzle so as to produce a maximum amount



CROSS SECTION OF POWELL OIL BURNER VALVE

of heat with a minimum amount of oil and air. It is also the purpose of the design to have a free and unobstructed passage of the oil that will not interfere with the proper flow.

This valve can be employed in connection with compressed air, or fan, blast or steam blowers. It is placed on the market by the William Powell Co., of Cincinnati, Ohio.

New Single-Phase Motor

A NEW line of single-phase motors Type "RI" Form C were recently put on the market by the General Electric Co. It is claimed that the "RI" power factor is high at no load and virtually approaches unity at the usual operating loads. "RI" torque—starting, accelerating and maximum running values—provide ample turning moment to meet virtually all the demands of electric drive.

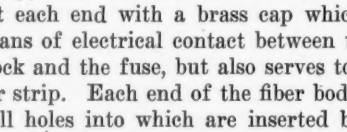
TYPE "RI" FORM C MOTOR

Type "RI" motors are built to cover a range between ¼ and 20 hp., inclusive. A simple change in the connections of outgoing leads makes these motors adaptable for either 110 or 220-volt circuits. A feature indicating the flexibility of "RI" design is that of speed adaptation; e. g., a given speed obtained through standard 60-cycle windings may also be secured for 25 or 40-cycle frequencies by simply modifying the windings.

Daum Refillable Cartridge Fuse Shells

IN THE accompanying illustration is shown a section of a Daum refillable cartridge fuse shell, as manufactured by A. F. Daum, Pittsburgh, Pa.

Essentially, this fuse shell consists of a fiber body provided at each end with a brass cap which not only forms a means of electrical contact between the clips of the fuse block and the fuse, but also serves to retain the fuse wire or strip. Each end of the fiber body is drilled with 2 small holes into which are inserted brass pieces of the form shown. The inner ends of these pieces



SECTION OF FORM 4—STRIP OR WIRE TYPE—DAUM REFILLABLE CARTRIDGE FUSE SHELL

project through the holes, and being somewhat wider at that end than the external diameter of the body, allow the threads inside of the cap to ride upon them and thereby secure the cap.

To insert a fuse strip, both caps are removed, the strip is passed through the shell and the ends are bent over the brass end pieces. The caps are then screwed in place and in so doing, grip the bent-over portion of the fuse strip between the end piece and the inside of the top of the cap.

News Notes

THE MANY FRIENDS of Mr. H. H. Hughson, formerly manager of the specialty department of the Illinois Engineering Co., successors to the Hughson Steam Specialty Co., of Chicago, will be pleased to learn that he has become associated with the Coon-De Visser Co., engineers and contractors, of Detroit. In his new connection, Mr. Hughson will devote his energies in the interests of Illinois Vacuum Systems and the Temperature Regulating field.

THE HOLLOW CENTER PACKING CO., with Ernest H. Smith as president and Everett N. Marcy as sales manager, has just been organized for the purpose of putting on the market "Ovalhole" Hollow Center packing, a new packing recently invented by Mr. Smith. Both Messrs. Smith and Marcy have been connected with the sales department of a prominent American packing concern for the past 6 yr., and have established their office at 608 S. Dearborn St., Chicago.

AT THE ANNUAL CONVENTION of the National Gas Engine Association held on June 27, 28 and 29, in the city of Chicago, the following officers were elected for the coming year: President: C. E. Bement, Gen. Mgr., Novo Engine Co., Lansing, Mich. Vice-Presidents: O. H. Fisher, President, Union Gas Engine Co., San Francisco, Calif.; G. M. Gillette, V.-P., Minneapolis Steel & Machinery Co. Minneapolis, Minn.; H. Harmer, President, Sawyer-Massey Co., Hamilton, Ont., Canada; W. E. Blair, Gen. Mgr., Buffalo Gasoline Motor Co., Buffalo, N. Y.; H. C. Blake, Secy., Foose Gas Engine Co., Springfield, Ohio; C. B. Dempster, Pres., Dempster Mill Mfg. Co., Beatrice, Neb.; E. H. Witte, President, Witte Engine Co., Kansas City, Mo.; T. C. Menges, Gen. Supt., Associated Manufacturers Co., Waterloo, Iowa, Secretary: H. R. Brate, Lakemont, N. Y., and Treasurer: O. M. Knoblock-Heideman Mfg. Co., South Bend, Ind.

No place for holding the next annual meeting was decided upon, but the time of holding all future meetings will be changed to the winter months instead of during the summer, as in the past.

The Secretary's report for the past year showed an increase in membership of 110, the largest growth the Association had experienced during any previous year.

AMONG THE Civil Service Examinations to be conducted by the United States Civil Service Commission during September and October, we note the following which will be of interest to readers:

On Sept. 13, assistant examiner, Patent Office; assistant inspector of boilers, Steamboat-Inspection Service; draftsman, Engineer Department at large; copyist, ship, Navy Department; junior engineer, mechanical or electrical, Engineer Department at large; laboratory apprentice, Bureau of Standards; local inspector of boilers, Steamboat-Inspection Service. On Oct. 11, aid, Bureau of Standards; draftsman, copyist, marine engine and boiler, Navy Department; engineer, Indian Service.

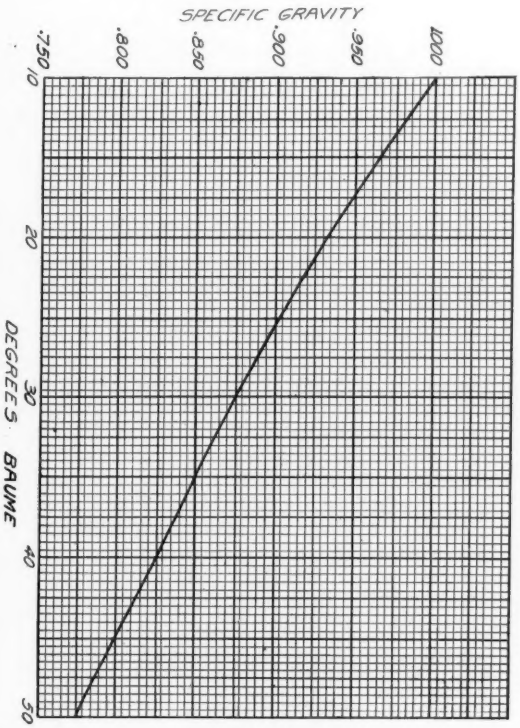
Application forms and full information in regard to the different named examinations may be obtained by addressing United States Civil Service Commission, Washington, D. C.

These tables contain data especially worked out or carefully selected that are vital to your work. You may need them. A handy, serviceable loose-leaf preserve them.

These tables contain data especially worked out or carefully selected that are vital to your work. You may need them at any time and should preserve them. A handy, serviceable, loose-leaf cover in which these tables fit exactly, will be sent you for 30 cents in currency or stamps.

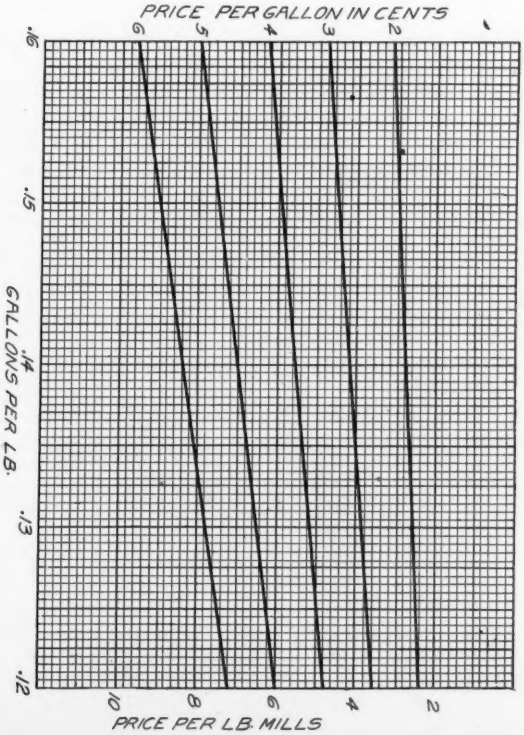
PRACTICAL ENGINEER

CHART I. RELATION BETWEEN DEGREES BAUME AND SPECIFIC GRAVITY



PRACTICAL ENGINEER

CHART III. RELATION BETWEEN PRICE PER GALLON AND PER POUND FOR OILS OF DIFFERENT SPECIFIC GRAVITIES



PRACTICAL ENGINEER

GALLONS OF WATER IN CYLINDRICAL TANKS, AXIS VERTICAL

Length or depth in ft.	DIAMETER IN INCHES									
	18	24	30	36	42	48	54	60	66	72
2	26	47	73	105	144	188	238	294	356	424
2½	33	59	90	131	180	235	298	367	445	530
3	40	71	109	157	216	282	357	440	534	636
3½	47	83	127	183	252	329	416	513	623	742
4	54	95	145	209	288	376	475	586	712	848
4½	61	107	163	235	324	423	534	659	801	954
5	68	119	180	261	360	470	593	732	890	1060
5½	75	131	200	287	396	517	652	805	979	1166
6	82	143	217	313	432	564	711	878	1068	1272
6½	89	155	235	339	468	611	770	951	1157	1378
7	96	167	253	365	504	658	829	1024	1246	1484
7½	103	179	271	391	540	705	888	1097	1335	1590
8	110	191	289	417	576	752	947	1170	1424	1696
8½		203	307	443	612	799	1006	1243	1513	1802
10		239	361	521	720	940	1183	1462	1780	2120
12		287	433	625	864	1128	1419	1754	2136	2544
14					1008	1316	1655	2046	2492	2968
16					1152	1504	1891	2338	2848	3392
18							2127	2630	3204	3816
20							2363	2922	3560	4240

PRACTICAL ENGINEER

COST OF STEAM

COST OF COAL PER TON OF 2000 LBS.	EVAPORATION PER POUND OF COAL FROM AND AT 212° F.																				
	5.00	5.25	5.50	5.75	6.00	6.25	6.50	6.75	7.00	7.25	7.50	7.75	8.00	8.25	8.50	8.75	9.00	9.25	9.50	9.75	10.00
	COST IN CENTS TO EVAPORATE 1000 POUNDS WATER FROM AND AT 212° F.																				
$1.00	10.0	9.53	9.10	8.7	8.33	8.00	7.70	7.42	7.14	6.90	6.66	6.45	6.25	6.06	5.88	5.73	5.56	5.40	5.27	5.13	5.00
1.25	12.5	11.9	11.3	10.8	10.4	10.0	9.62	9.25	8.93	8.62	8.33	8.07	7.82	7.56	7.35	7.15	6.95	6.75	6.57	6.42	6.25
1.50	15.0	14.3	13.7	13.1	12.5	12.0	11.5	11.1	10.7	10.4	10.0	9.68	9.38	9.10	8.82	8.57	8.35	8.12	7.90	7.70	7.50
1.75	17.5	16.6	15.9	15.2	14.6	14.0	13.5	13.0	12.5	12.1	11.7	11.3	10.9	10.6	10.3	10.0	9.73	9.47	9.22	8.98	8.75
2.00	20.0	19.0	18.2	17.4	16.7	16.0	15.4	14.8	14.3	13.8	13.3	12.9	12.5	12.1	11.7	11.4	11.1	10.8	10.5	10.3	10.0
2.25	22.5	21.4	20.4	19.6	18.8	18.0	17.3	16.7	16.1	15.5	15.0	14.5	14.1	13.7	13.2	12.9	12.5	12.2	11.8	11.5	11.2
2.50	25.0	23.8	22.6	21.6	20.8	20.0	19.2	18.5	17.9	17.2	16.7	16.1	15.6	15.1	14.7	14.3	13.9	13.5	13.1	12.8	12.5
2.75	27.5	26.2	25.0	23.9	23.0	22.0	21.2	20.3	19.6	19.0	18.3	17.7	17.2	16.6	16.2	15.7	15.3	14.9	14.5	14.1	13.7
3.00	30.0	28.6	27.4	26.2	25.0	24.0	23.0	22.2	21.4	20.8	20.0	19.4	18.8	18.2	17.6	17.1	16.7	16.2	15.8	15.4	15.0
3.25	32.5	31.0	29.6	28.3	27.1	26.0	25.0	24.1	23.2	22.4	21.7	21.0	20.3	19.7	19.1	18.6	18.1	17.6	17.1	16.7	16.3
3.50	35.0	33.2	31.8	30.4	29.2	28.0	27.0	26.0	25.0	24.2	23.4	22.6	21.8	21.2	20.6	20.0	19.5	18.9	18.4	18.0	17.5
3.75	37.5	35.6	34.1	32.6	31.3	30.0	28.9	27.8	26.8	25.9	25.0	24.2	23.4	22.7	22.0	21.4	20.8	20.3	19.7	19.2	18.7
4.00	40.0	38.0	36.4	34.8	33.4	32.0	30.8	29.6	28.6	27.6	26.6	25.8	25.0	24.2	23.4	22.8	22.2	21.6	21.0	20.6	20.0
4.25	42.5	40.0	38.6	37.0	35.4	34.0	32.7	31.5	30.4	29.3	28.3	27.4	26.6	25.8	25.0	24.3	23.6	23.0	22.4	21.8	21.2
4.50	45.0	42.8	40.8	39.2	37.6	36.0	34.6	33.4	32.2	31.0	30.0	29.0	28.2	27.4	26.4	25.8	25.0	24.4	23.6	23.0	22.4
4.75	47.5	45.3	43.2	41.3	39.6	38.0	36.5	35.2	33.9	32.8	31.7	30.6	29.7	28.8	28.0	27.2	26.4	25.7	25.0	24.4	23.8
5.00	50.0	47.6	45.2	43.2	41.6	40.0	38.4	37.0	35.8	34.4	33.4	32.2	31.2	30.2	29.4	28.6	27.0	26.2	25.6	25.0	

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CONTENTS OF CYLINDRICAL TANKS, AXIS HORIZONTAL

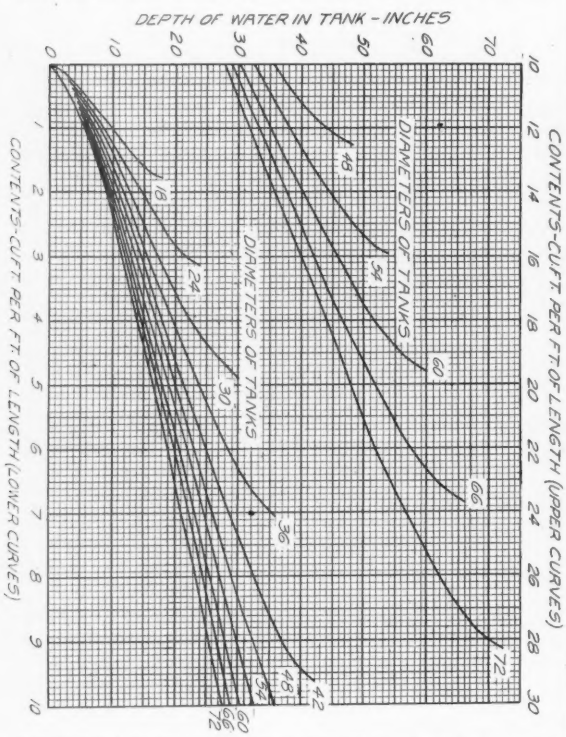

DEPTH OF WATER IN TANK - INCHES
CONTENTS-CU.FT. PER FT. OF LENGTH (LOWER CURVES)
CONTENTS-CU.FT. PER FT. OF LENGTH (UPPER CURVES)
DIAMETERS OF TANKS
DIAMETERS OF TANKS

CHART II. RELATION BETWEEN SPECIFIC GRAVITY AND POUNDS PER GALLON AND GALLONS PER POUND

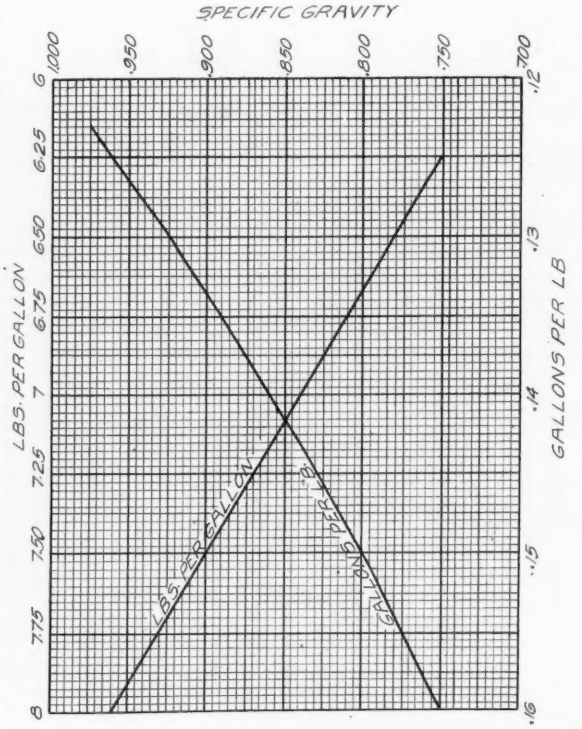


CHART FOR DETERMINING YEARLY SAVING DUE TO REDUCTION OF COAL CONSUMPTION

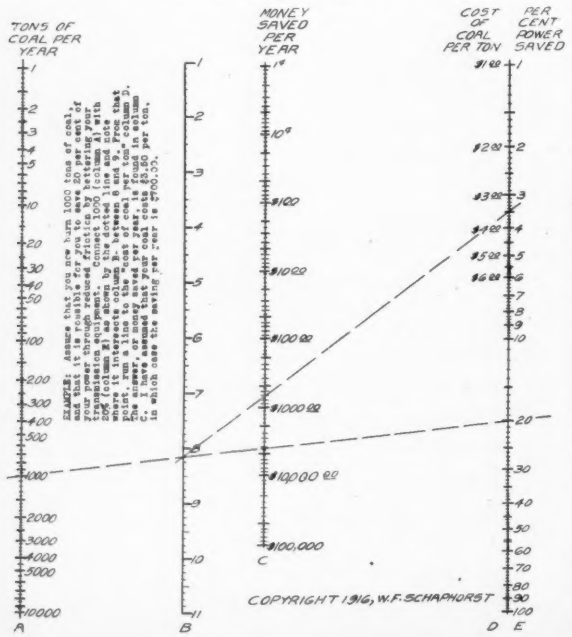
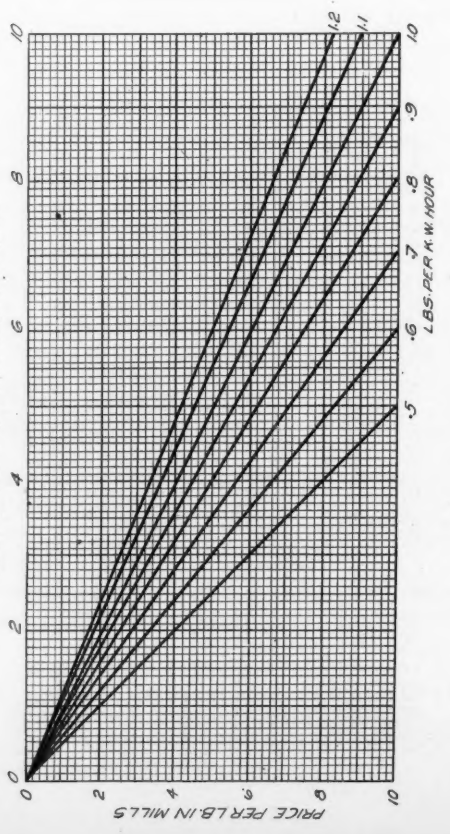

TONS OF COAL PER YEAR
MONEY SAVED PER YEAR
COST OF COAL PER TON
PER CENT POWER SAVED
EXAMPLE: Assume that you now burn 1000 tons of coal, and that it is possible for you to save 20 per cent of your power through reduced friction, by bettering your present system of lubrication. Connect 1000 (column A) as shown by the dotted line and 20 (column E) as shown by the dotted line and note where it intersects column B- between 6 and 7. Project that point, run a line to the cost of coal per ton in column D, and note that it intersects column C at $4.00 per ton. I have assumed that your coal costs $3.50 per ton, in which case the saving per year is $700.00.
COPYRIGHT 1916, W.F. SCHAPHORST
A
B
C
D
E

CHART IV. COST OF FUEL OIL PER KILOWATT-HOUR



Books and Catalogs

CENTRAL AMERICA as it really is, as a thriving and progressive section of our hemisphere, rich beyond measure in resources that have only been scratched, is the subject of a new handbook issued by the Bureau of Foreign and Domestic Commerce, of the Department of Commerce.

The author is concerned largely with the prospects for American trade and American capital in this promising region, which actually covers more square miles than the combined area of the whole of New England, New York, Pennsylvania, New Jersey, Maryland and Ohio. He finds that we already sell about 50 per cent of the goods imported, but is strongly of the opinion that a much bigger percentage of the business should be done by Americans as a result of present opportunities. To make the most of these opportunities, however, Mr. Harris declares it will be necessary to invest more American capital in the republics, to extend more liberal credits, to improve banking facilities for export trade, and to make more direct and personal efforts in the markets.

The report takes up each Central American country in turn and describes its physical features and climate, the character of the population, and the means of communication. It then takes up the agricultural, timber, and mining resources and the manufacturing industries, and follows this by a general description of the Government, a sketch of the banking system, and a statistical study of the foreign trade. The section devoted to each country is closed by an outline of the future prospects of trade and business in that country, and a list of specific commercial openings. There are three appendices: The first, a description of a practical route through Central America for commercial travelers; the second, regulations affecting commercial travelers; and the third, a list of publications concerning Central America.

The exact title of the new handbook is "Central America as an Export Field," Special Agents Series No. 113. It contains 229 pages, including 7 halftone illustrations and one map, and is for sale at the nominal price of 30 cents by the district offices of the Bureau of Foreign and Domestic Commerce and by the Superintendent of Documents, Government Printing Office, Washington.

WITH A VIEW to a better utilization of the vast deposits of lignite in the West Central and Western States, the United States Bureau of Mines conducted a number of investigations into the economic methods of using these lignites. Bulletin 89, "Economic Methods of Utilizing Western Lignites," by E. J. Babcock, of the University of North Dakota, has just been issued by the bureau.

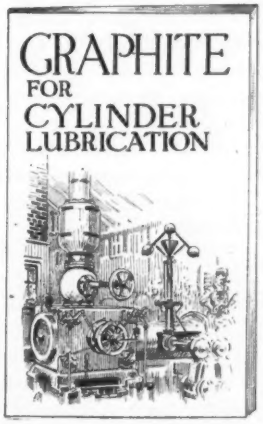
In this bulletin, the author says: "Among the States having the largest workable deposits may be mentioned North Dakota, Montana, Wyoming, Colorado and Texas, and in several other Western States lignite occurs in smaller areas. In North Dakota alone it is estimated that the deposits cover approximately 32,000 sq. mi., many of them being 10 to 15 ft. thick and capable of producing in all billions of tons of lignite.

"The college of mining engineering of the University of North Dakota, at Grand Forks, and at the mining substation, at Hebron, has begun extended work on a variety of new and practical methods of using lignite. In this work special attention has been paid to the production of gas and its utility and economy for heating, lighting, and power purposes and the manufacture of briquets.

"The purpose of this bulletin is to present a summary of the results thus far obtained in the work done, and to indicate the prospects that the results hold out for the future development of the lignite fields of the West. These results indicate that not only will lignite be much more serviceable and much more generally used, but an immense quantity of slack and coal that would otherwise be wasted will be saved.

"Furthermore, by the process described in this bulletin, large quantities of gas, especially valuable for power purposes, may be obtained at a low cost, as the work thus far carried on indicates that this gas can be used successfully with an internal-combustion engine for the production of electricity so as greatly to reduce the cost of power production and thus make possible a wider utilization of cheap electricity for industrial purposes."

GRAPHITE for Cylinder Lubrication is the title of an interesting booklet recently issued by the Joseph Dixon Crucible Co., of Jersey City, N. J. It tells of the methods for flake graphite lubrication applied to



steam engines, gas engines, marine engines, locomotives, and compressors. Copies of this booklet will be sent, upon request, to those interested.

THE TRILL INDICATOR CO., of Corry, Pa., has issued a new 56-page catalog, which is a most complete and up-to-date publication on engine indicators and indicating. The book is instructively illustrated and describes in detail the construction and purpose of the several parts of both the outside and enclosed spring types of indicators, including indicator reducing motion. Considerable space is given to discussion and data on indicator springs and full instructions on indicating and interpreting cards from all types of engines, high-pressure steam, gas and fuel oil engines, triple-expansion and compound engines and ammonia compressors. Detailed instructions are given on the application and use of the indicator and the planimeter, with easily understandable instruction on the few arithmetical calculations that are necessary. There are 15 pages illustrating

and discussing the characteristic diagrams of the several types of engines, including the latest 4-valve engines of the new Poppet Valve type, the Uniflow engine, high compression 2-cycle oil engine and the Diesel engine, also a large number of faulty diagrams, illustrating the characteristic faults of engines.

BUREAU OF MINES announces that the following new publications are ready, a limited supply being available for free distribution: Bulletin 91, Instruments for recording carbon dioxide in flue gases, by J. F. Barkley and S. B. Flagg; Bulletin 102, The inflammability of Illinois coal dusts, by J. K. Clement and L. A. Scholl, Jr., 1915; Bulletin 113, Abstracts of current decisions on mines and mining, reported from May to September, 1915, by J. W. Thompson; Technical Paper 113. Some properties of the water in coal, by H. C. Porter and O. C. Ralston; Technical Paper 126, The casting of clay wares, by T. G. McDougall; Technical Paper 131, The compressibility of natural gas at high pressures, by G. A. Burrell; Technical Paper 134, Explosibility of gases from mine fires, by G. A. Burrell and G. G. Oberfell.

INGERSOLL-RAND CO., 11 Broadway, New York, has recently issued 3 new bulletins as follows: Form 9023, on Imperial tie tamping outfits, describing an apparatus which is employed principally in the operations of laying and surfacing railroad track. Form 3026, on Ingersoll-Rogler class PRE duplex direct connected electrically driven air compressors. Features in the design of this compressor are: the Ingersoll-Rogler valve, the clearance controller, direct connected drive, improved intercooler, and auxiliary water separator. Form 3312, on Imperial XB duplex power driven air compressors. Copies of these bulletins will be forwarded to those interested upon application.

C. W. HUNT CO., Inc., has just issued a new Valve Catalog, 15-3. This catalog is standard 6 by 9 in. size, and contains illustrations and complete description of Hunt standard types of gates or valves for controlling the flow of bulk materials. The dimensions are given of those which are more frequently used in power house and storage pocket design. The cuts showing the application of these valves are selected with the idea of assisting where there is any question as to the type best suited to the requirements.

SOMETHING IN IT FOR YOU is the striking title of an attractive booklet just issued by the Westinghouse Electric & Mfg. Co. in order to assist its agents and dealers in marketing the Westinghouse Electric range. This illustrated booklet describes in a brief, concise manner the advantages of this type of range, and in addition outlines several methods of selling them and gives some suggestions covering newspaper advertising, window trims, demonstration, etc. The booklet is being distributed to central stations and dealers.

"THE EVOLUTION of Hand Pipe-Cutting Tools" is the title of an article recently published in the Plumbers' Trade Journal, and may now be secured in reprint form from the Borden Co., Warren, O., upon request.

PRACTICAL ENGINEER

Trade-mark, Reg. U. S. Pat. Off.

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Advertisements in this section are inserted under regular headings.
No display type allowed, but the first three words may be set in capital letters.
About nine words make a line. Minimum space sold, two lines.
Under classification "Position Wanted," advertisements not exceeding four lines will be inserted once for subscribers free of charge.
All copy should be received at Chicago office 18 days before date of publication.

Circulation of this issue, 22,500.

Technical Publishing Co.

537 S. Dearborn Street

Chicago

Position Wanted

POSITION WANTED—As master mechanic or assistant; 21 years' experience. Had charge of erecting, repairing heavy duty engines, machinery and mixed blow turbines. Expert on lubricants. Address Practical Engineer, Box 435, Chicago, Ill. 7-1-2

POSITION WANTED—Chief engineer in a small plant or operator in a large; 12 years' practical experience with steam, electric, refrigerating, pumping and condensing equipment. Technical education. First-class license and references; married, age 31, employed. Practical Engineer, Box 434, Chicago, Ill. 7-1-2

POSITION WANTED—As Chief Engineer or Manager of produce cold storage plant. Am familiar with gas, oil and steam engine driven plants, also with D.C. light and power of 250 volts. Erecting, repairing and operating. Employed; married, and sober. Will go anywhere. Address Box 428, Practical Engineer, Chicago, Ill. 3-15-1

POSITION WANTED—License chief engineer wants change; 12 years' experience in manufacturing and central stations, steam, electric, refrigeration and producer gas, high speed and Corliss engines, condensers, etc. Age 32, American and married. Address Box 437, Practical Engineer, Chicago, Ill. 7-1-2

POSITION WANTED—By chief engineer, 35, married. Use no liquor; 15 years' experience, electrical and refrigeration. Wants position where ability and push will count. Can get results if given opportunity. Practical Engineer, Box 436, Chicago, Ill. 6-15-3

YOUNG MAN, age 26, would like a position as helper in engine room where good advancement is assured. Am I. C. S. student. Will send information. Box 429, Practical Engineer, Chicago. 3-15-1

POSITION WANTED—As Chief Engineer. Am qualified to take full charge of power plant, A.C. or D.C., also refrigeration. Age 30. Married. Employed. Chicago only. Address Practical Engineer, Box 421, Chicago, Ill. 2-1-1

POSITION WANTED—Young man wants position as helper, extra engineer or fireman. Two years' practical experience. I. C. S. student. Write Rasmus Stenner, 300 Fremont St., Portland, Ore. 7-1-2

WANTED—Position as engineer in pumping station or in some stationary plant. I have had 4 years' experience in engineering. What have you to offer? E. W. Adkins, Charleston, Ill. 7-15-1

POSITION WANTED—Young man wants position as helper and extra engineer in steam plant for a start. Other particulars answered by letters. Write to W. D. Bellesfield, Rock Valley, Iowa. 5-15-4

POSITION WANTED—By young man as oiler or fireman in a modern plant. I. C. S. graduate. Address Frank Knapp, 323 S. 5th St., St. Joseph, Mo. 7-1-2

Help Wanted

WANTED—Resident subscription agents in the following cities: Atlanta, Ga.; Cincinnati and Columbus, Ohio.; Kansas City, Mo.; Los Angeles, Cal.; Louisville, Ky.; Newark, N. J.; New Orleans, La.; Portland, Ore.; St. Louis, Mo.; San Francisco, Cal.; Washington, D. C. This is an excellent chance for a hustler who is familiar with power plant conditions, to turn his spare time into dollars. To such a one we offer a Real Opportunity. Write Subscription Department, Practical Engineer, 537 S. Dearborn St., Chicago. tf.

Wanted

WANTED—Sales agent for Northwestern and Western Illinois and Eastern Iowa. To qualified sales producer, we offer an established and continuously advertised line of successful steam traps and temperature regulators. Liberal commission and complete co-operation from manufacturer. Address Practical Engineer, Box 443, Chicago, Ill. 7-15-1

WANTED—Agents handling engine and boiler-room specialties in every section for side line paying large commissions. Give experience, line carried and territory covered. Address Practical Engineer, Box 381, Chicago, Ill. tf.

WANTED—Agents to handle Chemicals for Boiler Rooms, Laundries and the Automobile Trade. Strictly commission basis. State age and experience. Address Practical Engineer, Box 440, Chicago, Ill. 6-1-6

WANTED—Agents on commission to sell our Shaking Grates. We will install grates on trial or put it on test at our expense with any grate made. Address Armstrong Mfg. Company, Springfield, Ohio. tf.

For Sale

FOR SALE—14x36 E. P. Allis Corliss engine, 100 hp., 100 r.p.m., cylinder re-bored, thoroughly overhauled one year ago; was good as new. Dubuque Brewing & Malting Co., Dubuque, Ia. tf.

Patents and Patent Attorneys

PATENTS THAT PROTECT AND PAY—Advice and books free. High references. Best results. Promptness assured. Send sketch or model for search. WATSON E. COLEMAN, Patent Lawyer, 624 F St., N. W., Washington, D. C. tf.

PATENTS—C. L. Parker, Attorney-at-Law and Solicitor of Patents. Patents secured promptly and with special regard to the legal protection of the invention. Handbook for inventors sent upon request. Washington, D. C. tf.

PATENTS—H. W. T. Jenner, Patent Attorney and Mechanical Expert, 606 F St., Washington, D. C. Established 1883. I make a free examination and report if a patent can be had, and the exact costs. Send for full information. tf.

A. P. CONNOR, Consulting Electrical and Mechanical Engineer, Attorney-at-Law and Solicitor of Patents and Trade-Marks. Results guaranteed. 121 Carroll St., S. E., Washington, D. C. tf.-x.

PATENTS—Send sketch for free search and reports. Books on patents and book of reference letters sent free. John S. Duffie & Co., 612 F St., Washington, D. C. tf.

PATENTABLE IDEAS WANTED—Send for three free books. R. B. Owen, 28 Owen Bldg., Washington, D. C. tf.

Miscellaneous

THE CITY OF WAHOO will receive bids up till 12 o'clock, July 26, for the purchase of the following machinery: One 225-hp., either simple or tandem compound Corliss engine, or one 225-hp. Uniflow engine, same to be direct connected to a 150-kv.a., 2300-v. generator, exciter, switchboards, 25-hp. motor and a triplex pump. Specifications are on file in the office of the water and Light Commissioner, City of Wahoo, Neb. 7-1-2

FREE ENGINEER BOOKS and power plant tools and specialties, for securing new subscribers to Practical Engineer. A dandy chance for the engineer with a little spare time, to get some fine premiums. Send for free descriptive circular and terms. Address Practical Engineer, Subscription Department, Chicago, Ill.

ENGINEERS, DO YOU WANT to utilize your exhaust steam for heating or drying purposes without back pressure on your engine? If so, address Monash Engineering Co., 1413 W. Jackson Blvd., Chicago, Ill.

Sparks From The Advertising Pages

A Ten Million Dollar Increase in Yearly Income

Being a digest of the address made by R. Goodwyn Rhett before the Philadelphia Convention A. A. C. of W.

IT is exceedingly difficult for me to present to you such a picture of Prosperous America in the short time at my command as would enable you to carry away any adequate conception of it. Figures are dry and of themselves would leave a poor impression.

And yet merely to tell you that a constant procession of ships is carrying out of this country the greatest volume of exports that has ever been carried from any country on earth, and bringing into it the greatest volume of imports it has ever known—while at the same time bringing us within the year $500,000,000 of gold and nearly $2,000,000,000 of our own securities, converting it from a debtor to a creditor nation, would be insufficient; to tell you that our factories are working night and day to turn out products at profits never before dreamed of—that our mines are turning out coal, iron, copper and other minerals in unprecedented volume and at unprecedented prices; that towns and cities have sprung into existence within the year; that our railroads are groaning under freight which is beyond any former record; that our farmers are reaping harvests not only immense in volume but more immense in value; that even the Southern farmers, laid prostrate upon the opening of the war by a loss of $350,000,000 in the value of their cotton, but thereby learning a much needed lesson in economy and thrift, are now taking their proper place in the panorama of Prosperous America; that banks have increased their deposits everywhere to such an extent as to leave no doubt of the prosperity of almost every industry in the land; to tell you all this would still leave with you a very vague conception of America's prosperity. Our foreign trade not only exceeds that of any country on the globe, but it is more than twenty-five per cent greater than last year or any previous year in our history.

When it comes to manufacture it is impossible to give any adequate idea of the enormous expansion that has taken place in that field. Almost every factory in the land is operating and operating at a profit.

The demand for coal is fifty per cent in excess of normal at this time of the year, and the sale of electricity for light and power has increased $28,800,000, and is eighteen per cent in excess of last year. Capital issues have increased over $400,000,000 in the first four months of this year. In the past year *National* bank deposits have increased over two and a half *billions* of dollars which indicates that the increase in total deposits will probably run over $5,000,000,000. Bank clearings show an increase of sixty-eight per cent over May, 1914, before the war broke out. Our railroads show receipts for ten months ending with April of over $1,500,000,000 over the previous year and an excess in net earnings of a half billion dollars.

In brief the income of Prosperous America is now estimated to have increased from thirty billions in 1915 to forty billions in 1916, and to be far and away in excess of any thing ever before reached by any country in the world.